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Shell-Fisheries in the Andamans

IN reviewing the activities of the Zoological Survey of India during the years 1932–35, and 1935–38, we have had occasion in our editorials of December 1935 and of April 1939, to refer briefly to the part played by this Department in the scientific investigation of problems of economic importance such as, for instance, amongst others, the shell-fisheries in the Andamans. The recent publication by this Department of a *Consolidated Report on the Shell-Fisheries in the Andaman and Nicobar Islands during the years, 1930–35* enables us to assess the value of the fishery research work which the Department had been called upon to undertake early in 1930, under conditions not comparable to those of enlightened Governments more prosperous and resourceful than the Government of India. Many departmental reports suffer the fate of being filed and forgotten in Government Secretariats, but we are happy to note that the Director, Zoological Survey of India, has consolidated the reports of his scientific staff and published the results of six years' hard work in an intelligible form, so that they may be available to the general public interested in the scientific and economic progress of this country.

The Report is divided into three parts, the first of which deals with (1) the genesis and history of the shell-fishery in the Andaman Islands; (2) the fishing methods of the Japanese who discovered the valuable beds of Top and Turban shells (*Trochus niloticus* and *Turbo marmoratus*) around the islands of the Andaman and Nicobar groups; and (3) the scientific work of the officers of the Zoological Survey on these shell-fishes and their recommendations to preserve and perpetuate the shell-fishery. The second part consists of Tables of measurements of the

shell-fish and their eggs, of records of field-studies and of various other data on which the entire Report is based. The third part embodies the reports of individual officers deputed for fishery work which serve as a reference to the study of the first part. A grasp of the topography of the Andaman and Nicobar Islands and the adjacent islands of the Bay of Bengal and the Malay archipelago is greatly facilitated by the inclusion in the Report of two maps of these islands.

A sudden accession of wealth is no less embarrassing to Governments than to individuals. The knowledge that extensive and valuable mother-of-pearl shell-beds were discovered for them unintentionally by a band of intrepid Japanese in the territorial waters of the unguarded and uninhabited coasts of the two hundred and odd islands under their administrative charge seems to have put the Local Government at Port Blair in an unenviable position of embarrassment. The Andamans Government, however, lost no time in issuing licences to the Japanese of Singapore to collect mother-of-pearl shells on these coasts and in collecting royalty on the quantities of shells fished. They also realised at the same time that it was necessary to assess the extent of this new marine wealth and the possibilities of its further exploitation, and to take adequate steps to safeguard the fishery as a permanent source of income. The Local Government's timely decision to call in the aid of the Zoological Survey to solve the problems of exploitation and preservation of the fishery was praiseworthy for its wisdom and far-sightedness.

The preliminary investigation by the Zoological Survey early in 1930 not long after a fleet of Japanese fishing vessels had been apprehended in Port Blair was concerned not only with the *Trochus* and *Turbo* shell-fishery but also with the exploitation of other sources of marine products including edible fish and Trepang or *Beche-de-mer*. This investigation showed that with proper management of the shell and other fisheries a net annual income of not less than Rs. 40,000 may be anticipated, an income that could meet the cost of a permanent staff of Zoologists at Port Blair to advise the Local Government on their fishery problems. The Government of India on the recommendations of the Director, Zoological Survey, based on the results of this investigation sanctioned a scheme of research for five years in the first instance, and appointed at Port Blair a marine Zoologist trained and recruited in England as the Research Officer to study the shell-fish and the fishery in detail and provide a scientific basis for the control of the fishery. Although the avalanche of the Government of India retrenchment schemes of 1931 descended on this officer when he had been in office for barely six months, the scheme of research was saved by the Zoological Survey stepping into the breach. At the end of the five-year period, however, the research work on the fishery which was by no means complete was abruptly terminated on grounds of financial stringency, when further facilities for essential research and for the safeguarding of the already depleted fishery were urgently needed.

Before dealing with the scientific aspects of the Report before us we wish to draw attention to the fact that the investigating officers of the Zoological Survey had from the commencement of the investigation early in 1930 realised that the shell-beds were bound to suffer serious depletion in the absence of an efficient inspecting staff to

control the licensed fishermen and to keep out poaching boats from fishing in territorial waters. That they had raised a warning finger is evident in their individual reports. The Director, Zoological Survey, in his preface to the present Report lays emphasis on this subject and, what was more serious from the point of view of the investigating officers, on the absence of a properly equipped laboratory fitted up with aquaria and running sea-water, and other requisites of sound biological work which, as he remarks, "made it impossible for the officer-in-charge to carry out detailed investigations on the bionomics, life-history, etc., of *Trochus niloticus*". It is difficult to understand why the Government of India agreed to initiate a scheme of research without a careful and adequate consideration of the immediate and future needs of their investigating officers. It is a pleasant surprise to us, however, that in spite of the handicaps of smallness of staff and meagreness of equipment the Zoological Survey was able to carry on its investigations in the Andamans for over five years and produce results which are of a no mean order.

The author of the consolidated Report who carried on investigations in the Andamans from 1932 onwards seems to have accumulated a great wealth of statistical and observational data which, we are glad to find, have been incorporated in the present Report. For, they not only help to understand the conclusions of the author but justify the control measures which the author has recommended for the regulation of the fishery. The facilities for the collection of these data which the Local Government were able to provide the author must have been utterly inadequate when compared to those which the Japanese licensees were in a position to give, and the author wisely availed of all the opportunities which the latter provided him of accompanying their fishing boats to the shell-beds around most of the islands of the Andaman and Nicobar groups in spite of the inevitable inconveniences of a small fishing craft. The data collected on these cruises with the Japanese were chiefly concerned with the rate of collection of shells by divers in various beds, the size, number and sex of shells collected in a day, the state of development of the eggs in various sizes of shells and the nature of the enemies affecting the life and commercial value of the shell-fish. The records of the size of eggs in *Trochus niloticus* of all available sizes from various localities show clearly that a fairly large percentage of shells 9 centimetres in maximum diameter is fully mature and bears a majority of full-sized eggs 0·20 to 0·25 millimetres in diameter, and justify the introduction of a 9·0 centimetre shell-gauge designed to prevent the fishing of young and immature shells. Unfortunately, *Trochus* shells 8·5 to 10·0 centimetres in maximum diameter seem to be of the highest market value because of the brilliant lustre of the mother-of-pearl layer on the inner surface of the shell and of the comparative freedom of the outer surface of the shell from animal or vegetable growths. The Japanese naturally regard these sizes of shells as constituting a first class commodity, and the graphs on pages 17 and 18 of the Report bear out the fact that the Japanese, during the years 1933–36, at any rate, preferred shells with maximum diameter of about 9–10 centimetres to those of other sizes, although in practice shells of less than 9 centimetres diameter with percentage frequency ranging from 5 to 20 had been fished in these years. The effect of the removal of young shells from the beds

farther away from Port Blair is not apparent because of the lack of facilities for collection of systematic data in those areas. But a picture of the systematic depletion of the large-sized shells in the shell-beds in the vicinity of Port Blair is provided by the graph on p. 16 of the Report which shows that in the four years 1931–32 to 1934–35 the percentage frequency of the small shells 3 centimetres in maximum diameter has gone up from as low a figure as 0·5 to about 45. The author was, however, able to show in 1934 (p. 20 of the Report) that the mean-size of shells in the Nicobar area collected in different months of a single fishing season showed a distinct tendency to fall as the months passed by as a result of intensive fishing in the same area, and we have no doubt that results similar to those gathered at Port Blair would have been obtained had it been possible to collect further data in the Nicobars.

The study of the rate of growth of *Trochus niloticus* was restricted to shells of certain bigger sizes only, as the experiments on the embryonic and the immediately higher stages of the shell-fish do not appear to have proved a success for lack of laboratory facilities of the right type. The experimental study of shells of 5 centimetres and above in maximum diameter has shown (1) that the rates of growth vary inversely with size of shell; (2) that growth in diameter is closely correlated with growth along the whorls of the shell; (3) that the female shell grows faster than the male shell; (4) that growth of shell is not influenced by seasonal variations; and (5) that the longevity of the species is approximately ten years. It is also clear from these studies that upto the end of the second year of their life the shell-fish have a size-range of 5·0 to 8·0 centimetres diameter when they are sexually unmature, and that the third year represented by the size-range 8·0 to 10·0 centimetres diameter is the most critical in their life as they then attain sexual maturity and begin to breed,—a stage at which the Japanese find it most profitable to market them. The reconciliation of the interests of the Japanese licensees and of those of the shell-fishery seems therefore, to have been a difficult matter when the Local Government had no means of enforcing the strict observance of their fishery regulations.

The ascertained facts in regard to the rate of growth at various ages or sizes of shells also show that if young shells in their second year of growth, that is, when they are 5·0 to 8·0 centimetres in maximum diameter, are allowed to grow for one fishing season more they will have reached maturity in their third year of life when they are 8·0 to 10·0 centimetres in maximum diameter, and have had at least one chance of leaving sufficient progeny to maintain the numerical strength of the beds depleted by fishing.

The introduction of a close season coinciding with the breeding period of the animal concerned is one of the well-known and recognised methods of regulating a fishery. The author of the Report has shown from a study (1) of the incidence of very young shells throughout the year; (2) of the percentage frequencies of various sizes of shells at any locality and in any part of the year; and (3) of the state of the reproductive products throughout the year, that *Trochus niloticus* breeds more or less continuously unlike many species of molluscs in temperate zones, which breed only in certain restricted seasons. The fixing of a close season for the Andamans cannot therefore be based on the breeding period of *Trochus*. The severity

of the monsoon from May to September when fishing is impossible along the Andaman and Nicobar coasts provides a natural though compulsory close-season.

From the economic point of view the shell-fishery in the Andamans proved to be a disappointment during the latter half of the period of the fishery. The steep decline in tonnage of shells in the second year of the fishery and the steady fall thereafter are clearly indicated in the graph on p. 24 of the Report. No one with knowledge of these shell-fisheries in other countries could have expected a better fate for the Andaman fishery which was at no stage under any sort of control by the authorities. Rules and regulations, if not rigorously enforced, do not carry conviction. The *Trochus* fishery in Mergui, Burma seems to have suffered a very similar fate. Making ample allowance for natural fluctuations in the breeding of *Trochus* and for variations in the period of fishing and in the number of divers employed for fishing shells, the decline of the fishery in the Andamans and in the Mergui archipelago is due, as the author of the Report points out, to the unrestricted and indiscriminate fishing of shells of all sizes by licensed as well as unlicensed Japanese fishermen, well organised and financially supported by the Japanese-owned fishery companies of Singapore. How efficient and thoroughly organised are the Japanese in the exploitation of the marine resources of the Indo-Pacific seas is vividly described by the author on pages 2 to 4 of the Report.

The fact that the Andamans and Nicobars and the Mergui archipelago are unguarded may have served as an invitation to the Japanese to explore the sheltered bays and winding creeks along these coasts, inaccessible to vessels larger than a small steam-launch or motor boat. It is not surprising therefore that many instances of poaching have been frequently reported to the respective Governments during the last few years of shell-fishing. We have seen occasional newspaper reports of arrests and trials of the Japanese masters of the fishing boats, and of confiscations and heavy fines as a deterrent punishment. The fact that the Japanese still dare to visit these coasts show that poaching is enormously profitable, and that the Governments concerned are helpless to prevent poaching. Contrast the measures taken by the Queensland and New Caledonian Governments to protect their shell-fisheries which have been stabilised during the past quarter of a century with the introduction and enforcement of stringent regulations.

The concluding part of the Report shows that the *Trochus* shell fishery has suffered such severe depletion that its rehabilitation would be almost an impossibility unless the Government of India is prepared to prohibit fishing of shells throughout the Andaman and Nicobar area for a period of at least three years, and at the same time keep their coasts clear of poachers by constant and vigilant patrolling. It is too much to hope that the Indian Government will agree to spend large sums of money on the policing of these islands to save an industry, the highest anticipated revenue from which is not expected to meet the cost of maintaining a preventive and scientific staff. All the same we cannot help expressing our regret that an important new marine industry has been allowed to go to ruin, because of the inability of the Government of India to keep away foreign exploiters from these islands. Far from wishing for a worse turn in the present international situation the *Trochus*

beds have still a chance of complete revival in the event of a European War which will give them a prolonged rest. We may recall the fact that many depleted fisheries of the North Sea and the Atlantic revived completely after the last Great War, and we have every hope that an enforced rest to the shell-beds in the Andamans such as a world war alone can give will restore them to their former plenitude.

We are of the opinion that the economic exploitation of our land and marine resources for the benefit of our people is a paramount duty of the Government of the country and no cost, however high, must be reckoned as an impediment to such exploitation. The National Planning Committee which recently met at Bombay seems to have decided that its immediate objective should be the establishment of new industries under the guidance and direction and with the material aid of the State, and the expansion of existing industries. It is also understood that the committee has appointed a separate sub-committee on fisheries. We earnestly hope that this sub-committee will fully consider the question of reviving the shell-fish industry of the Andamans.

The Liaison-Officer for India on the Staff of the Royal Botanic Gardens, Kew

THE appointment of Dr. K. N. Kaul of the Lucknow University, to serve as liaison-officer for India on the Staff of the Herbarium of the Royal Botainc Gardens, Kew, for a period of 2½ years, has recently been announced in the press. This appointment marks a new departure in filling this post, which is likely to promote very greatly the study of systematic botany in India, and enable India, in course of time, to have a number of systematic botanists trained at Kew and having first-hand knowledge of the Collections of Indian type material available at Kew and other European herbaria.

In order that Indian Scientists may realise the importance of the development, a brief history of the post may be given.

In 1883 there existed three main herbaria in India, those at Calcutta, Madras and Saharanpur, which could function properly only by maintaining close contact with Kew where all standard Indian collections were preserved. In order to meet the demands for information from these herbaria without undue delay, the India office agreed to appoint an assistant for India who was to devote himself to the interests of the Indian botanical institutions and *pari passu* to the maintenance and elaboration of the Indian botanical collections at Kew.

The assistant for India at Kew has actively collaborated in the preparation of the monumental flora of British India and the several provincial floras based upon it. The type material on which these standard works are based being preserved in the Kew Herbarium, no identification of Indian material can be really authoritative without comparison of these types at Kew. The services of the assistant are continually required in comparing and verifying such material, and in conducting enquiries of considerable economic importance both in agriculture and forestry.

The post has upto now been mostly held by botanists with wide experience of India, after their retirement. The experience gained by these officers has thus been completely lost to India. As a matter of fact no Indian

botanist had the opportunity of obtaining first-hand knowledge of the Indian collections preserved at Kew during the 55 years that the post has been maintained from Indian revenues.

Attention to this glaring anomaly was drawn by Prof. S. P. Agharkar during the session of the Third Imperial Botanic Conference held in London in 1935. Sir Arthur Hill, who presided over the Conference, dwelt on the question of the appointment of botanists as liaison-officers who could be appointed by Dominion Governments to work at Kew and drew attention to the admirable system adopted by the Union of South Africa whereby one of their younger systematic botanists was appointed to work at Kew for a period of two or three years, when he would be replaced by another member of the Union's botanical staff. He also mentioned that in this way a number of systematic botanists had acquired Kew training and experience and had been of inestimable value to the study of botany within the Union of South Africa. Discussion on the suggestion that a similar procedure should be adopted in the case of the assistant for India, was not permitted by the Chairman on the ground that the suggestion was not relevant to the proposal before the Conference.

On his return to India, Prof. Agharkar placed his views before the scientific organisations in India and as a consequence, representations were made to the Government of India to adopt the South African model for the appointment of the assistant for India by the *National Institute of Sciences of India*, the *Indian Botanical Society* and the *Indian Science Congress Association*. These proposals were, however, not agreed to by the Government of India, on the ground "that continuity of work in directions that call for long and undivided study may be maintained".

The question was taken up again in 1937 by Prof. B. Sahni and Prof. S. P. Agharkar as the result of which Sir Arthur Hill, Director of the Royal Botanic Gardens, Kew, expressed his approval of the proposal to the Government of India and suggested that the Government of India might give the proposal their careful consideration at the time of filling the post on the retirement of Mr. C. E. C. Fischer in July 1939. The question was also discussed at the symposium on "A National Herbarium for India", during the Silver Jubilee Session of the *Indian Science Congress* and the proposal approved.

It is gratifying to note that as a result of these efforts, the Government of India have agreed to the adoption of the South African model for the appointment of the assistant for India at Kew in future, and Dr. Kaul has been appointed to the post.

It is also satisfactory to note that the salary of the post, which was fixed as £ 100–10–160 p.a. many years ago, has now been increased to £ 250–5–260 p.a.

We hope that Dr. Kaul will fully utilise the opportunities offered to him during the next 2½ years so as to enable him to undertake a part of the work of identification of Indian plants in India itself.

S. P. A.

The Frequency of Polyembryony and Chlorophyll Deficiency in Rye

By Prof. Dontcho Kostoff

(*Academy of Sciences, U.S.S.R.*)

THE studies by Kappert[1] in *Linum* and those by Ramiah, Parthasarathi and Ramanujam[2] in *Oryza* showed that some plants, developing from twin seedlings are haploids. Namikawa and Kawakami[3] raised adult plants from wheat twins and found haploid, triploid and tetraploid plants among those with normal chromosome numbers. Studies in this field were carried out more recently on a large scale by a series of investigators. I shall recall here those by Harland,[4] Müntzing,[5] etc., which also showed that polyembryony leads to euploid chromosome alterations.

At the present time we have good methods for producing polyploid plants (colchicine, acenaphthene, bromnaphthalene, bromacenaphthene, etc.), but no reliable methods for producing haploids.[6] X-rays, abnormal temperatures and interspecific hybridizations seem to be less effective in this respect than polyembryony.

Haploids were reported in a large number of plants, when the latter are viable in highly inbred (homozygous) condition. *Secale cereale* is a cross fertilizer, which "degenerates" when inbred, therefore haploids from this plant would usually be lethal or semilethal. I attempted to verify this deduction. In doing this 27,020 grains of *Secale cereale* var. *viakta* were sown in boxes with sand. The surface was divided into 1 cm. × 1 cm. squares and then single grains were placed in each square half covered in sand. The seeds were watered regularly. Thus we raised 20,393 seedlings from 27,020 grains. Among these seedlings we found 5 twins, one triplet and 27 albinos. All ten plants from the twins and two of the triplet, that were studied cytologically had the normal somatic chromosome number, namely $2n = 14$. We also grew 39,606 seedlings in sowing 53,780 grains of *Secale cereale*—like derivatives from the interspecific cross *S. cereale* × *S. montanum*. Among these seedlings we found 32 twins and 7 albinos (Table I). Sixty plants of the twins had 14 somatic chromosomes, and one of them was a triploid (N 38) having 21 somatic chromosomes. Six plants of the twins died in an early stage of development, three of which were not studied cytologically. One of the diploid twins was a structural hybrid forming: (1) $5^{II} + 1^{III} + 1^{I}$, (2) $5^{II} + 1^{IV}$ and (3) $6^{II} + 2^{I}$; its twin plant being normal. Triploid plant formed a large percentage of abortive pollen, on the average 72 per cent. (July), 68 per cent. (September), 84 per cent. (October). Most of the pollen grains appeared usually in two when matured and studied in aceto-carmine preparations, one or both of the twin pollen being usually abortive. When only one of the twin pollen is abortive, the viable twin pollen was much larger than the abortive one (Figs. 1 and 2).

TABLE I

Plants	Seeds sown	Seedlings grown	Pairs of twins found		Triplets	Albinos	
			Number	Per cent.		Number	Per cent.
Secale cereale var. *viatka* ..	27,020	20,393	5	0·029	1	27	0·132
Secale cereale-like derivatives from *S. cereale* × *S. montanum* ..	53,780	39,606	32	0·08	..	7	0·0176
2411 *Triticum vulgare*	23,220	18,275	4	0·021	..	..	..

During the first meiosis we found 0 to 5 trivalents, most frequently, however, 2, 3 and 4 trivalents were formed. The plant formed eight spikes, six of them had altogether 216 spikelets, *i.e.*, 432 flowers. These six spikes set 8 grains from free pollination, two of the grains being small, shrunken with bad embryos. They did not germinate. Two spikes were bagged. No seeds were set under the bags.

The studies upon polyembryony in rye were followed up with similar studies in soft wheat—a plant that can be highly homozygotized without "degeneration" symptoms.

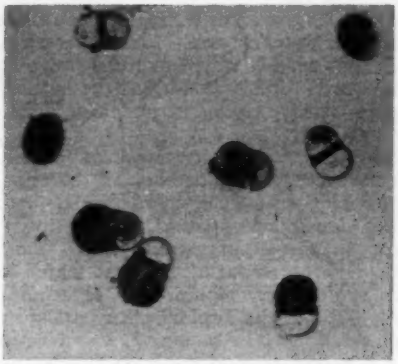

FIG. 1

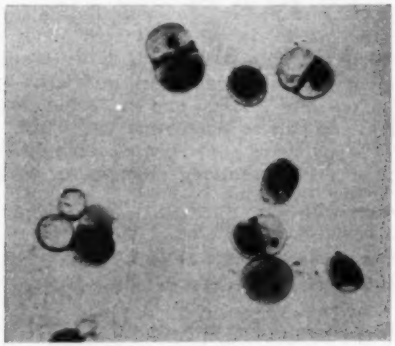

FIG. 2
Pollen from the triploid rye

We raised 18,275 seedlings from 23,220 grains of *Tr. vulgare* No. 2411. Among these seedlings we found four pairs of twins (Table I). Two seedlings of two different pairs were haploid ($n = 21$) while the other six seedlings developed into normal diploid (($2n = 42$) plants. Haploid plants were smaller, than the normal ones. Their spikes were smaller. During the first meiosis we usually found in aceto-carmine preparations from one of the haploids 21 univalents or one bivalent and 19 univalents. In a few cells two bivalents were found. In a single pollen-mother cell three bivalents were observed.

Out of 73 plants raised from rye twin pairs and studied cytologically only one triploid and one structural hybrid was found but no haploids, while two haploids were raised out of eight wheat twin pairs, i.e., 25 per cent. of haploids.

Until the present time adult haploids of *Secale cereale* have not yet been raised. Müntzing[7] obtained a semi-lethal haploid rye among the material treated by abnormal temperatures. Absence of haploids among the twin pairs that we studied is due most probably to the dying off of the haploids in an early stage of development; the diploid twin pairs being only able to survive and grow further.

There is a good deal of speculation about the mode of origin of more than one embryo in a single ovule. When polyembryony is a sequence of nucellar embryony, the embryos, the seedlings, and the plants that develop from them should be diploid with maternal genetic constitution. Twin embryos should also be diploid when they originate from two cells derived from the first cleavage products of the fertilized egg. When one embryo develops from the fertilized egg and the other from an endosperm all diploid + triploid twins may originate. When one embryo develops from the fertilized egg and the other from a haploid embryo sac cell (antipodal, for example) diploid + haploid twins will be formed. In the latter case it might happen that diploid + diploid twins develop if chromosome doubling takes place in the haploid embryo at an early developmental stage. Diploid + diploid twins or diploid + diploid + diploid triplets might also originate if two pollen-tubes penetrate the micropyle, the sperm of the one fertilizing the egg nucleus, while the other sperms fertilizing the polar nucleus and one or more than one antipodal nuclei. We do not know yet the mode of origin of tetraploid plants from twins and polyploids of a higher order. Fusion of antipodal cells and then polyspermic fertilization seem to be more probable processes, than chromosome doubling in one of the pairs of diploid + diploid twins at an early stage of development, but the latter alternative is not excluded.

The twins of *Secale* that we studied do not seem to result from nucellar embryony because they differed morphologically.

The normal procedure of the meiosis and normal fertility of the twin plant of the structural twin hybrid also supports this assumption. Structural hybrid formed about 50 per cent. of abortive pollen (Fig. 3) and was partially fertile.

Diploid + diploid *Secale* twins do not seem to result from diploid + haploid twins after a chromosome doubling in the haploid

one at an early developmental stage, because a diploid, derived from a haploid rye

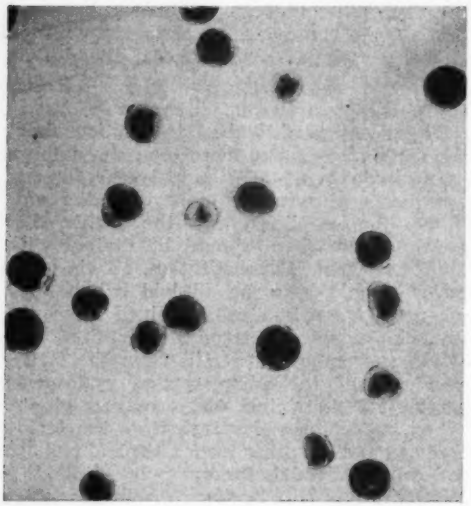

FIG. 3
Pollen from the structural hybrid raised from a twin pair

by somatic doubling will be nearly absolute homozygous form, the latter being usually semi-lethal or lethal. The most probable origin of the twin seedlings in rye that I studied seems to be: one from the fertilized egg and the other from a fertilized antipodal cell, the triploid resulting, most probably, from an endosperm cell. It seems very probable that usually single plants develop from *Secale* twin diploid + haploid embryos, the haploid usually dying at an early developmental stage.

Polyembryony in angiosperm plants is a very common phenomenon. They are chiefly due, as a rule, to certain deviations in the developmental and fertilization processes in the embryo-sac. They lead to euploid chromosome alterations, which have great evolutionary significance, especially the tetraploid and the haploid with partial autosyndesis during the meiosis.[6] The frequency of the polyembryony in our experiments is very high. In the rye *Viatka* it is about one per 3,500 and in *Secale cereale* derivatives—one per 1,200. In wheat it was about one per 5,000. The frequency of chlorophyll deficiency (albino seedlings) in *Viatka*—rye was about one per 800 and in *Secale cereale* derivatives it was about one per 6,000.

These numbers show an exceedingly high frequency of hereditary changes.

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[1] Kappert, H., *Biol. Zentral.*, 1933, **53**, 276.

[2] Ramiah *et al.*, *Curr. Sci.*, 1933, **1**, 277.

[3] Namikawa and Kawakami, *Proc. Imper. Acad.*, Japan, 1934, **10**, 668.

[4] Harland, S. G., *Jour. Heredity*, 1936, **27**, 229.

[5] Müntzing, A., *Cytologia*, Fujii Jub. Vol., 1937, 211.

[6] Kostoff, D., *Bibliographia Genetica*, **14** (in the press).

[7] Müntzing, A., *Hereditas*, 1937, **23**, 401.

Thyroxine from Casein

LUDWIG and Mutzenbecher (*Z. Physiol. Chem.*, 1939, **258**, 195) have prepared thyroxine from casein by treating it with iodine under carefully defined conditions in the presence of sodium bicarbonate and subsequent hydrolysis with barium hydroxide. The product, before hydrolysis contains 6·8 per cent. of organic iodine and has a thyroid activity of 200–500 guinea-pig units per gm. One gm. of this material yields on hydrolysis 50–100 mg. of crystalline thyroxine.

This work has now been confirmed by Harington *et. al.* (*Nature*, 1939, **144**, 205) who also broadly discuss the mechanism of the synthesis.

LETTERS TO THE EDITOR

Temperature Dependence of Lindemann Frequency

Recently we have shown[1] that the surface-tension γ_f of a liquid at its melting-point T_f is given by

$$\nu_f = k\sqrt{\frac{\gamma_f}{m}},$$

where ν_f is the Lindemann frequency and m the mass of the molecule. Assuming that the expression holds at all temperatures, we have at any temperature T,

$$\nu = k\sqrt{\frac{\gamma}{m}}$$

whence from Eötvös rule we get

$$\nu = k\sqrt{\frac{\gamma V^{\frac{2}{3}}}{m V^{\frac{2}{3}}}} = k'\sqrt{\frac{T_c - T}{m V^{\frac{2}{3}}}}$$

and

$$\nu_f = k'\sqrt{\frac{T_c - T_f}{m V_f^{\frac{2}{3}}}}.$$

It follows that

$$\frac{\nu}{\nu_f} = \sqrt{\frac{T_c - T}{T_c - T_f}}\left(\frac{V_f}{V}\right)^{\frac{1}{3}} = \left(\frac{V_f}{V}\right)^{\frac{1}{3}}\sqrt{\theta},$$

which shows *directly* the decrease of ν with rise of temperature.[2] The surface-tension at any temperature becomes——and it follows also directly from Eötvös rule——

$$\gamma = \frac{1}{k^2} m \nu_f^2 \frac{T_c - T}{T_c - T_f}\left(\frac{V_f}{V}\right)^{\frac{2}{3}}$$
$$= \gamma_f\left(\frac{V_f}{V}\right)^{\frac{2}{3}}\theta.$$

The viscosity at any temperature on Andrade's formula becomes

$$\eta = \eta_f\sqrt{\frac{T_c - T}{T_c - T_f}}\left(\frac{V_f}{V}\right)^{\frac{1}{3}}$$
$$= \eta_f\left(\frac{V_f}{V}\right)^{\frac{2}{3}}\sqrt{\theta}.$$

It has been shown by one of us previously[3] that

$$V^{\frac{10}{3}}(T_c - T) = \text{constant},$$

whence $V = V_f\,\theta^{-\frac{3}{10}}$ .. .. (1)

and it follows that

$$\nu = \nu_f\theta^{\frac{3}{5}} \quad .. \quad .. \quad (2)$$

$$\gamma = \gamma_f\theta^{\frac{6}{5}} \quad .. \quad .. \quad (3)$$

$$\eta = \eta_f\theta^{\frac{7}{10}} \quad .. \quad .. \quad (4)$$

and compressibility

$$\beta = \beta_f\theta^{-1.3} \quad .. \quad .. \quad (5)$$

of which the relation (3) is similar to Van der Waals' equation and (4) is of limited applicability.

Thus it is seen that many of the physical properties of the liquids show a temperature dependence directly as function of a new reduced temperature θ defined by $\frac{T_c - T}{T_c - T_f}$.[4]

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Department of Physics,
University of Mysore,
Bangalore,
August 1, 1939.

[1] Sibaiya and Rama Rao, *Nature*, 1939, **143**, 723.
[2] Macleod, *Proc. Phy. Soc.*, 1938, **53**, 788.
[3] Sibaiya, *Curr. Sci.*, 1938, **6**, 329.
[4] Bauer, Mugat and Surdjn, *Trans. Far. Soc.*, 1937, **33**, 81.

Some Interesting Phenomena at the Solid-Liquid Transition of Colloidal Stearic Acid

STEARIC ACID sols (prepared by the addition of an alcoholic solution of the substance into boiling water) are found to exhibit, on standing, the phenomenon of "Schlierung" in a striking manner. In the course of an investigation it was observed (K.S.R. and K.S.G.D.) that the Schlieren effect disappeared sharply on heating and reappeared in the cold, on standing. Ultra-microscopic examination revealed that the rod-like particles of colloidal stearic acid changed to spherical ones on heating and resumed their original shape in the cold (on standing). These observations afford a most convincing line of evidence to show that the Schlierung phenomenon is caused by the non-spherical shape of the particles. Further work with purified sols [(Late) M. P. V. Iyer and K.S.G.D.] revealed the following facts:—(*a*) the change occurs in the neighbourhood of the melting-point of stearic acid (66·8°C. ± 0·2°C.), (*b*) there is an inflection at the same temperature, in the conductivity-temperature curve of the sol and (*c*) there are sharp changes (as revealed by preliminary measurements) in the intensity and depolarisation of the light scattered by the particles at the same temperature. Details of these investigations as well as the subsequent work done on the subject will shortly be published elsewhere.

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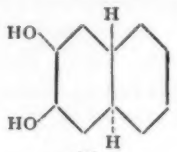
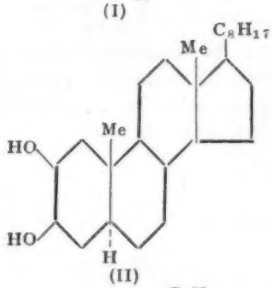
The Configuration of the C_3 Hydroxyl Group in the Digitonin Precipitable Steroids

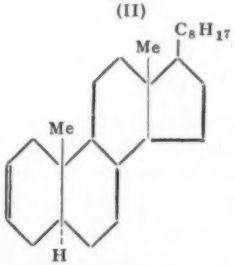
THERE are many indirect evidences to indicate that the C_3 hydroxyl group in the steroids which precipitate with digitonin, is *cis* to the C_{10}-methyl group.[1, 2] A direct and absolute proof for this appeared to be obtainable by extending our studies on the stereochemistry of the 2:3-dihydroxy *trans* decalins (I)[3] to the 2:3-dihydroxy cholestanes (II) which can exist in four stereoisomeric forms (the isomerism herein concerned being due only to the two hydroxyl groups attached to C_2 and C_3), of which in one the hydroxyl groups are in the *trans* and in the rest in the *cis* positions. So, starting from neocholestene (Δ^2-cholestene III)[4] and also 2:3-diketocholestane,[5] by adopting the same methods as in the synthesis of the 2:3-dihydroxy *trans* decalins,[3] we attempted the synthesis of the four 2:3-dihydroxy cholestanes. Recently, Marker and Plambeck[6] have reported the synthesis of a 2:3-dihydroxy-cholestane (II), m.p. 201°, by the oxidation of Δ^2-cholestene (III) with hydrogen peroxide and



(I)



(II)



(III)

similarly 2-hydroxyandrosterone and 2:3:17-trihydroxyandrostane also from Δ^2-androstenone-17 and androstenol-17 respectively, all these new hydroxyl compounds, as a class, not precipitating with digitonin. Since we are not

at present able to persue our work, we here give our interpretation of the results of Marker and Plambeck in the light of our study of the 2:3 dihydroxy-*trans* decalins.

The non-precipitability of this 2:3-dihydroxy cholestane of Marker and Plambeck with digitonin is taken by us to be due to its C_3 hydroxyl group possessing the *epi* (α-) configuration,* a view also expressed by the American authors as a possibility. The other possibility that the presence of the adjacent C_2 hydroxyl group in the above compound may interfere with the formation of the additive compound with digitonin[7] does not appear to be plausible because it has been found by Rosenheim[8] and also by Marker (personal communications to the author) that the presence of the additional hydroxyl grouping at C_4 in cholesterol, cholestanol, sitosterol and stigmasterol does not influence their digitonin precipitability. It is thus to be expected that two of the 2:3-dihydroxycholestanes should precipitate with digitonin.

We assign the *trans*-configuration to the hydroxyl groups of the 2:3-dihydroxyl cholestane of Marker and Plambeck for the reasons: (i) the oxidation of the cyclic double bond with hydrogen peroxide (in the absence of osmium tetroxide) and the hydrolysis of the cyclic oxide yield the same *trans* glycol[3] as for example in the preparation of 3:5:6-trihydroxy cholestane (m.p. 231°) from cholesterol[10] and (ii) if the hydroxyl groups are in the alternative *cis* position (with the C_3 hydroxyl group being of the *epi*form), by analogy with the behaviour of the *cis* 2:3-dihydroxy *trans* decalin (m.p. 128), the compound should isomerise on treatment with acetic anhydride,† which has not been observed.

It can be seen from the space model of 2:3-dihydroxy cholestane that in the *trans* form, the C_3-hydroxyl group, now fixed to be of the *epi* configuration, is in the *trans* position to the C_{10}-methyl group. This leads to the conclusion that in the digitonin precipitable steroids, the C_3-hydroxyl group occupies the *cis* position with reference to the C_{10} methyl group; only the two inferences drawn above by analogy have to be checked experimentally to make this proof more rigorous.

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July 29, 1939.

* We now consider the non-precipitability of gitogenin and digitogenin with digitonin as being due to the *epi* configuration of the C_3 hydroxyl groups.[7] This view appears to be compatible with the concept of Lettré[9] of the formation of additive compounds of the sterols.

† It also appears that the C_2 and C_3 hydroxyl groups in gitogenin and digitogenin are in the *trans* positions for the same reasons as in the case of 2:3 dihydroxy-cholestane now considered.

[1] Ruzicka, Furter and Goldberg, *Helv. Chim. Acta*, 1938, **21**, 498.
Cf. also *ibid.*, 1933, **16**, 327; 1934, **17**, 1395, 1407; 1935, **18**, 61.
Vavon and Jakubowicz, *Bull. Soc. Chim.*, 1933, **53**, 581.
Lettré, *Ber.*, 1935, **68**, 766.
Miescher and Fischer, *Helv. Chim. Acta.*, 1938, **21**, 336.
Chem. & Ind., 1939, **58**, 113.

[2] *Cf.* however, Cook, *Annual Rep. Chem. Soc. London*, 1936, **33**, 341.

[3] *Ber.*, 1939, **72**, 1381.
Cf. J. Indian Chem. Soc., 1938, **15**, 407.

[4] Mauthner, *Monats.*, 1909, **30**, 643.

[5] Stiller and Rosenheim, *J. Chem. Soc.*, 1938, 353.

[6] *J. Amer. Chem. Soc.*, 1939, **61**, 1332.

[7] Tschesche and Hagedorn, *Ber.*, 1935, **68**, 2248.

[8] Rosenheim and Starling, *J. Chem. Soc.*, 1937, 378.

[9] *Annalen*, 1932, **495**, 41.

[10] Westphalen, *Ber.*, 1915, **48**, 1064.
Pickard and Yates, *J. Chem. Soc.*, 1908, **93**, 1678.
Criegee, *Ber.*, 1932, **65**, 1770.

Heterogeneous Reaction between Chromic Sulphate and Manganese Dioxide

It has been found that when a solution of chromium sulphate is shaken with solid manganese dioxide, dichromate ions are formed in the solution. The reaction takes place as

$$Cr_2(SO_4)_3 + 3MnO_2 + H_2O = 3MnSO_4 + H_2Cr_2O_7$$

The above mode of reaction has been established by estimating the amounts of dichromate ions and manganese sulphate formed and the amount of chromium sulphate used up in the reaction. It has been found that (i) the gram

molecules of the dichromate ions formed in the reaction are equal to those of the chromium sulphate used up and (ii) the ratio of the gram molecules of manganese sulphate to that of dichromate formed is very nearly equal to 3.

The reaction takes place fairly rapidly in the beginning but slows down later. The rate of the reaction increases on increasing (i) the mass of manganese dioxide, (ii) the concentration of chromium sulphate and (iii) the temperature, but it decreases when coarser particles are used and the pH of the chromium sulphate solution is decreased. The rate becomes very rapid when manganese dioxide in the colloidal state is used.

On plotting the values of $K_m = 2{\cdot}3/t \log a/a-x$, against $v = x/t$, straight lines are obtained which intersect the axis of v on the negative side. These results indicate that the mechanism of the reaction under investigation is probably the same or similar to the catalytic decomposition of nitrous oxide on the surface of platinum catalyst studied by Hinshelwood and Prichard.[1] It has also been found that straight lines drawn for reactions, carried out with solutions of chromium sulphate of the same concentration and manganese dioxide of particles of different sizes, determined roughly by the mesh of the sieves used, are coincident. These observations show that both b and k in the equation[2]

$$V = \left(a + \frac{1}{b}\right) K_m - \frac{k}{b}$$

are constant, as required by the theory.

Detailed results are being communicated for publication elsewhere.

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Chemical Laboratories,
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July 7, 1939.

[1] *J.C.S.*, 1925, **127**, 327.
[2] Hinshelwood, *loc. cit.*

Effect of β-Indolyl 3-Acetic Acid and Phenyl Acetic Acid on the Growth of Some Members of the Family *Saprolegniaceae*

IT was first shown by Neils Nielson that under certain conditions of culture, a growth substance is formed by *Rhizopus suinus* and *Absidia ramosa* which influences cell-elongation in *Avena*. Later on, it was found that besides these two fungi a number of others also produced growth-substance. As shown by Kogl and Kostermans[1] this substance is β-Indolyl acetic acid which can also be isolated from urine (Kogl, Haagen Smit and Erxleben). It is a decomposition product of tryptophane. The physiological effects of β-Indolyl acetic acid on higher plants are about the same as those of auxin, but there are certain differences which may be due to the fact that it does not become oxidised so easily. It accelerates and retards cell-elongation in coleoptiles and roots, initiates growth in secondary meristematic tissues as well as formation of callus and roots and causes inhibition of bud-development. Crocker, Zimmermann, Hitchcock and Wilcoxon working at the Boyce Thomson Institute, have in recent years, shown that 32 different substances in all especially aromatic acids and esters are able to bring about a series of effects similar to those which are also brought by auxin and β-Indolyl acetic acid.

With a few exceptions, very little work has been done so far on the effect of various growth substances on the filamentous fungi. Leonian[2, 3] has shown that there are produced by corn roots and certain unicellular algæ substances of the nature of auxins which promote growth and reproduction of *Phytophthora cactorum* when added to ordinary nutrient media. Leonian and Lilly[4] tested about one hundred fungi with regard to the effect of β-Indolyl acetic acid (hetero-auxin) on their growth and came to the conclusion that the higher concentrations of this substance proved toxic and the lower ones failed to induce any stimulation. Wolf[5] studied the effect of α-naphthelene acetic acid on the growth of *Saprolegnia ferax* and *Achlya bisexulis* and found that a definite

inhibition of growth occurred in the presence of this synthetic growth-promoting substance.

In the present work the effect of β-Indolyl acetic acid and phenyl acetic acid (obtained from B.D.H.) has been studied on the growth of the following members of the family Saprolegniaceæ:—*Achlya dubia* Coker, *Pythiopsis intermedia* Coker, *Aphanomyces camptostylus* Drechs., *A. Cladogamus* Drechs., and *Thraustotheca clavata* (deBary) Humph. A synthetic medium with 0·1 gm. K_2HPO_4, 0·1 gm. $MgCl_2$, 1·0 gm. NH_4NO_3, 0·05 gm. cystin and 1·0 gm. of dextrose in one litre of distilled water was employed in these experiments. The concentrations of β-Indolyl acetic acid and phenyl acetic acid used, ranged between one part in 10 millions to one part in 5,000. The fungi were grown in scrupulously clean triplicate pyrex culture tubes each of which contained about 12 c.c. of the solution and were kept at 25° C. The relative growth of the fungi was measured from the vertical rise of the fungal colony on the third, fifth and seventh day after inoculation.

It has been found that in all cases lower concentrations (1:10 millions and 1:1 million) of the two growth substances induced no acceleration of growth, while concentrations higher than these caused a gradual inhibition, till with the concentration 1:5,000 the growth was even less than one-fourth of the growth in the controls in each case.

It is therefore concluded that these two growth substances, which have been found to stimulate growth in the higher plants, are of no value to these fungi as growth stimulants and rather inhibit the growth in higher concentrations.

The writer is indebted to Dr. R. K. Saksena for some valuable suggestions and criticisms.

M. S. Murdia.

Department of Botany,
University of Allahabad,
July 22, 1939.

[1] *Z. Physiol Chem.*, 1934, **113**, 228.
[2] *J. Agr. Research*, 1935, **51**, 277.
[3] *Bot. Gaz.*, 1936, **96**, 554.
[4] *Am. J. of Botany*, 1937, **24**, 135.
[5] *Ibid.*, 1937, **24**, 119.

Occurrence of Xenia in Pearl Millet (*Pennisetum typhoideum*) Stapf and Hubbard

The colour of the grain in the Indian varieties of pearl millet is whitish blue or bluish green of different intensities. The author, however, found two types of grain differing in colour, golden yellow and light bluish green, in a small sample of seed of an African variety he obtrained from Nawnagar in 1934. The two kinds of grain were sorted out and sown separately in two different localities at Palitana during the following season in 19. . While the bluish greens all bred true, giving only earheads with bluish green seeds, among the yellows some bred true to yellow grain, while others segregated into yellow and bluish green seeds in the same earhead. The actual segregation in nine plants given below was a rough 3:1 of yellow to bluish green.

Totals for 9 families	Yellow grain 46,499	Bluish green grain 15,062

Close to the place where the yellow grained plants were grown, there were a few plants grown in pots of an Indian variety of pearl millet with bluish green seeds. Three months after planting when the earheads were ripening in the Indian variety of pearl millet, there were observed on the earheads of this variety a few grains of a distinct golden yellow colour. Since this Indian variety was previously known to breed true to bluish green seeds, the yellow grains occurring in them were suspected to be the result of natural cross pollination from the yellow grained type of the African millet growing nearby. At harvest these yellow grains, 41 in number, were collected and planted separately in the following year. In every case the grain proved to be of hybrid origin as the plant resulting from it produced earheads with both yellow and bluish green seeds occurring in them. The segregation of golden yellow to bluish green were in different proportions some of which were a clear 3:1, others 9:7, and still others with an indefinite 2 to 2·5:1. The genetics of the grain colour has now been worked out and it is found to involve three factors.

A paper on the inheritance of grain colour is being published separately.

The fact that a few golden yellow grains occurred in a head of an Indian variety breeding pure for bluish green, by cross pollination from the African variety and that these yellow grains later gave plants with golden yellow and bluish green seeds occurring in the same earhead indicate the occurrence of true xenia, the first of its kind observed in pearl millet.

Z. H. PATEL.

Palitana,
Kathiawar,
July 23, 1939.

A Note on *Pennisetum typhoideum* Rich. (*bajri*) affected by *Striga densiflora* Benth.

SEVERAL members of the genus *Striga* are parasitic on other flowering plants. Of these *S. lutea* is found to attack some members of the gramineæ. Among its known cultivated hosts, those of economic importance are sugarcane (*Saccharum officinarum* L.), *jowar* (*Andropogon sorghum* Hack.), maize (*Zea mays* L.), finger millet (*Eleusine coracana* Gaert.), *vari* (*Panicum miliare* Lamk.), rice (*Oryza sativa* L.) and several pasture grasses. Besides these some non-graminaceous and also a few dicotyledonous weeds act as hosts. Because of its pestilential character *Striga* has attracted the attention of workers in different countries to check its spread. Of those who have worked on *Striga* Van Buuren[3] makes a mention of having observed *bajri* attacked by *S. lutea* on the Poona Agricultural College Farm in 1915. He has illustrated the attack of *S. lutea* on *jowar* but not on *bajri*. Sawyer[2] gives a list of hosts affected by it as determined by tests in the Botanical Laboratory at Mandalay in which *bajri* (*Pennisetum typhoideum* Rich.) is included as one. He, however, does not mention having observed *bajri* being affected by *S. lutea* or any other *Striga* species in the open field. Saunders[1] in his list of hosts of *S. lutea* includes *bajri* based on Sawyer's list.

The writer has been collecting the seed of *Striga* species for the past seven years on the Poona Agricultural College Farm but has not come across a single *bajri* plant affected by them. In determining the host range of *Striga* species in the laboratory it was observed that *Striga lutea* seeds germinated when placed in contact with the roots of *bajri* but not those of *S. densiflora*. Beyond this no evidence of attack on *bajri* by either *S. lutea* or *S. densiflora* was observed in the open fields. Last year in the course of collecting seeds of *Striga*, a *bajri* field affected by one of the species of this genus of parasitic flowering plants (Fig. 1) was

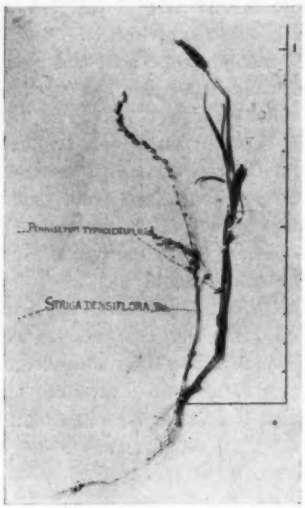

FIG. 1

Bajri (*Pennisetum typhoideum*) attacked by the parasitic flowering plant *Striga densiflora*.

observed on the outskirts of the Wadki Village, ten miles from Poona. A few of the host plants with the parasites growing close to them were carefully uprooted, brought to the laboratory and were examined. It was found that the parasite had definitely established connection with the *bajri* host (Fig. 2). The species of the parasite attacking *bajri* was identified as *S. densiflora*. Enquiries made indicate that in some parts of Khandesh, *bajri* has been affected by *Striga* to the extent of being definitely observable. If there had been attacks in the past they must have been so negligible as to have escaped notice.

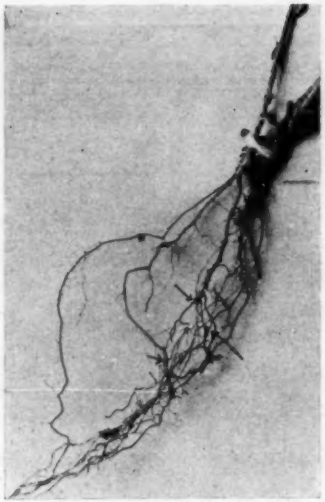

FIG. 2

An enlargement of root system seen in Fig. 1. The arrows point to places where knots have been formed due to the haustoria of the parasite (*S. densiflora*) penetrating the tissue of the host (*P. typhoideum*).

The species of *Striga* found to attack *bajri* so far are *S. lutea* as observed by Van Buuren and *S. densiflora* reported for the first time in this note. Besides these species there is a third, *viz.*, *S. euphrasioides* and it is not known whether this too attacks *bajri*.

Several persons since Van Buuren who have worked on *S. lutea* have not definitely confirmed his observation. It is the purpose of this note to confirm not only Van Buuren's observation regarding *S. lutea* but to state that *bajri* affected by *S. densiflora* has been observed in the open on a perceptible scale during the *kharif* season of 1938.

L. S. S. KUMAR.

Agricultural College,
Poona,
June 20, 1939.

[1] Saunders, A. R., *Dept. Agri. Union of S. Africa, Sci. Bull.* No. 128, 1933.
[2] Sawyer, A. M., *Dept. Agri. Burma, Bull.* No. 18, 1931.
[3] Van Buuren (Jr.), H., *Poona Agricultural College Mag.*, 1915, **5** and **6**.

Insects as Test Animals for Nutritional and Vitaminic Studies

ALTHOUGH several investigators in the past, have employed insects for nutritional and vitaminic studies, the problem has not received any sustained and systematic attention. *Drosophila malanogastor* has been widely employed in such studies by Loeb,[1] Loeb and Northrop,[2] Bogdonow,[3] Guyénot,[4] Wollman,[5] Sweetman and Palmer[6] and more recently by Hoog.[7,8] Loeb and others demonstrated the dependence of *Drosophila* on a supply of yeast for their normal development and completion of their life-cycle. The floor beetle, *Tribolium confusum* Duval, was employed by Sweetman and Palmer[6] as an indicator animal for vitamin research. They found that a growth-promoting factor analogous or closely allied to the vitamin B complex, was necessary for the normal development of these insects. Hoog[7,8] has reared *Drosophila* under aseptic conditions and used them for vitamin investigations. He has shown the response of these insects to the vitamin B complex and also to an active factor in the unsaponifiable portion of fats, and indicated that these insects are of value in the biological assay of vitamins B_1 and B_2. Trager and Subbarow[9] have shown that the larvæ of the yellow fever mosquito (*Ædes ægypti*) require certain accessory growth factors, vitamin B_1 and B_2 which they normally obtain from living micro-organisms. While our work was in progress Rubinstein and Shekun[10] announced that "the development of the newly hatched *Galleria* larvæ can serve as a most sensitive biological test for detecting minute quantities of nicotinic acid".

It is clear from the above, that insects are capable of serving as experimental animals for researches on Nutrition and Vitamins. With the recent and spectacular advances achieved in the field of ultra-micro technique,[11] it was felt that the problem of employing insects in such studies should be viewed in an altogether new perspective. The new technique offers us

methods of estimating ultra-micro quantities of metabolic products which result in the course of nutrition studies, thereby enabling us to determine the biological value of proteins.

Among the advantages offered by insects for such work may be mentioned: (1) their short life-cycle securing economy of time and rapid replication, and facilitating the study of factors determining longevity; (2) their fecundity offering large numbers of research material and enabling statistical analysis and interpretation; and (3) their smallness of size contributing to economy in apparatus and research material.

We have commenced intensive studies on nutrition and on the assay of vitamins with the rice moth, *Corcyrus* sp. The eggs were obtained through the kind courtesy of the Entomologist to the Government of Mysore and the larvæ hatched out of these eggs have been employed in all our investigations. Unmistakable indications of their adaptability for such work, were shown by the pilot experiments which have now been carried out. The insects respond not only to certain deficiencies but also to the supplementation of these deficiencies. Insects fed *en masse* on a diet deprived of its vitamin B_1, showed a poor growth while those treated with a full diet followed their normal course of development. [See Fig. 1 (A) and (B) and Table I.]

TABLE I

Diet	Average weight of larva in mg. after 45 days. (Average of 50 larvæ.)
Normal Diet	16·6
Vitamin B_1-free diet	3·4
Whole Jowar	17·7
Alcohol-extracted Jowar ..	3·7
Ether-extracted Jowar ..	1·4

It has been found that Jowar constitutes a complete and adequate diet to these insects but when Jowar is extracted either by alcohol or by ether, the residual meal is found to be

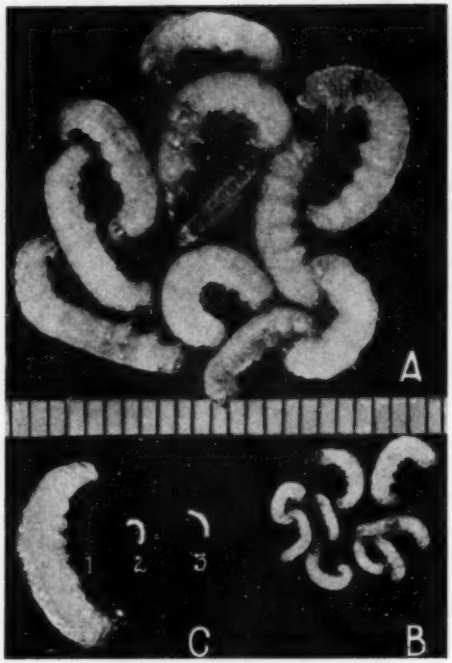

FIG. 1

A.—A representative batch of 10 larvæ fed *en masse* on a normal diet.

B.—A representative batch of 10 larvæ fed on a vitamin B_1-free diet.

Note.—Both batches taken from an *en masse* culture of 50 larvæ.

C.—(1) Larva fed on whole Jowar; (2) Larva fed on Jowar extracted with alcohol; (3) Larva fed on Jowar extracted with ether.

N.B.—All the larvæ are 45 days old. Scale: in millimetres.

a very poor diet [see Fig. 1 (C) and Table I]. When, however, the residual meal is supplemented with these extracts, normal development is restored. These findings have established the eminent suitability of these insects for nutritional and vitaminic studies. Further work is in progress.

Our grateful thanks are due to Mr. B. N. Sastri for fruitful co-operation, to Dr. Y. V. S. Rau for helpful suggestions and to Dr. S. A.

Kabir of the Forest Research Laboratory, Bangalore, for his kindness in photographing these insects.

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Bangalore,
August, 14, 1939.

[1] *J. Biol. Chem.*, 1935, **23**, 431.
[2] *Ibid.*, 1916, **27**, 309.
[3] *Arch. Physiol. Suppl.*, 1908, 173.
[4] *Compt. Rend. Soc. Biol.*, 1913, **74**, 178.
[5] *Ann. L'Inst. Pasteur*, 1911, **25**, 79.
[6] *J. Biol. Chem.*, 1938, **77**, 33.
[7] *Zeits, Vitaminforschung*, 1935, **4**, 300.
[8] *Ibid.*, 1936, **5**, 118.
[9] *Biol. Bull.*, 1938, **75**, 75.
[10] *Nature*, 1939, **143**, 1064.
[11] Numerous publications from the Carlsberg Laboratory, Copenhagen, by Linderstrøm-Lang & his associates.

Anacardic Acid and its Derivatives as Textile Auxiliary Agents

IN a recent resumé of the chemistry of detergents published in this *Journal*, one of us[1] has referred to the marked wetting power of the sodium salt of anacardic acid, a C-pentadecardienyl salicylic acid occurring in cashew nut shell oil. The work originated from a sample of the substance and its tetrahydro derivative very kindly supplied to us by Dr. P. Pillay[2] some years ago, and formed a part of a general study in progress in this laboratory on the relation between the chemical constitution of textile auxiliary agents and their properties, such as wetting, emulsification, detergency, dispersion of calcium soaps and promotion of level dyeing. The limitations of the methods at present available for determining wetting power have been discussed elsewhere[4] and it was shown that the Herbig method, applied under the conditions standardised by Evans,[5] offers certain advantages. Using a modified form[6] of the Evans apparatus, devised by one of us and others and now being marketed by Messrs. *A. Gallenkamp & Co.*, sodium anacardate and tetrahydroanacardate gave the following Herbig figures in comparison with certain commercial wetting agents.

This apparatus, however, involving a process of centrifugal hydroextraction, is unsuitable for examining the wetting power or penetrating power of auxiliaries used in the mercerisation of grey cotton, since these have to function under strongly alkaline conditions. During the course of an investigation by Mr. N. C. Mitra of this problem and of the

TABLE I

Reagent	Herbig Number					
	1·0%	0·75%	0·5%	0·25%	0·1%	0·05%
Sodium anacardate ..	72·9	67·2	62·2	60·3	49·7	43·5
Sodium tetrahydroanacardate ..	63·4	61·2	56·3	51·8	43·4	32·7
Product V* (Sodium lauryl sulphate) ..	72·5	71·6	70·2	59·1	50·4	41·8
Product Y* (Sodium salt of oleyl N-methyl-taurine)	62·9	61·7	61·2	58·5	54·7	52·2
Product X* (sodium dialkylnaphthalene sulphonate)	80·8	76·9	73·2	58·9	48·6	37·4

(* These were used in chemically pure form).

chemical character of the reagents that possess the special property of improving the wettability of grey cotton by caustic soda solutions of mercerising strength, it became obvious that anacardic acid and its derivatives should have interesting properties from this point of view. Anacardic acid, anacardol and their saturated analogues were insoluble in strong caustic soda solutions, but a mixture of anacardic acid and cellosolve in specified proportions was miscible with the mercerising alkali and exhibited a wetting power comparable with commercial products.

The wetting power of anacardic acid is diminished by hydrogenation. A series of wetting agents have been prepared by the condensation of anacardic acid and tetrahydroanacardic acid with arylamine sulphonic acids, following the synthetical lines outlined in earlier work.[3, 7] The sulphonation of anacardic acid and its esters and the action of maleic anhydride on these products have also been studied in order to arrive at wetting agents with improved properties in various directions, particularly in regard to the ability to resist hard water.[8] In the light of the synthetic resins with base exchange properties described by Adams and Holmes,[9] the ability of resins prepared from anacardic acid and anacardol to act as organic water softeners or "Organolites"[10] is being examined. By distillation of cashew nut shell oil *in vacuo*, anacardol (decarboxylated anacardic acid) can be readily prepared in quantity, and various syntheses with anacardol and tetrahydro-anacardol as starting materials are also in progress. One example is the condensation of these phenols with ethylene chlorhydrin, followed by sulphation of the phenoxyethyl alcohol thus obtained.

While carrying out tests on the mildewing of cotton goods on behalf of local mills, a method was developed for the estimation of salicylanilide ("Shirlan") in calico.[11] The high potency of the substance as an antiseptic for sized cotton, and its characteristic substantivity enabling its diffusion from warp to weft, led us to undertake a comprehensive examination of the chemistry of textile antiseptics. The antiseptic requirement for the prevention of mildew in cotton is a specific property, of which an adequate estimate cannot be obtained by a consideration of the phenol coefficient or other assay of antiseptic power. In the present experiments the procedure adopted was to add a known quantity of the antiseptic in the form of an aqueous solution to 0·1 g. of farina, make up to 10 c.c., gelatinise in a boiling water-bath for 3 minutes, plug the tubes with cotton, sterilise in an autoclave for 20 minutes at 15 lbs. steam pressure, cool and inoculate with a culture prepared from mildewed cloth.[12] The inhibition concentration was taken as the per cent. concentration of the antiseptic in the medium at which no growth of the organism was visible after 4 days, representative values for certain antiseptics being recorded in the following table. The phenols were dissolved in the molecular proportion of caustic soda solution.

While the germicidal and medicinal properties of the oil of the pericarp of *Anacardium occidentale* are recognized,[13] and uses for the oil as a preventive against whiteants and as a dressing for leprosy, ringworm and ulcers have been stated, the interest of anacardic acid as an antiseptic for textiles lies in its constitution as a C-alkylated salicylic acid, the anilide and analogous derivatives of which may be expected to combine the antiseptic properties of "Shirlan" with a wetting power derived from its polar character comprising a hydrophilic phenolic hydroxyl and a hydrophobic long chain alkyl residue. It will be noticed from Table II that the anti-mildew action of anacardic acid is of no particular interest, but more favourable results from certain of its derivatives are indicated.

Reference to anacardic acid in a recent write-up[14] from Baroda has necessitated this note. We should also add in this connection that we are in constant touch with our neighbour, Dr. R. C. Shah, with regard to his work on the constitution and synthesis of anacardic acid and related substances, and have ensured that our

TABLE II

Antiseptic	Inhibition concentration
Phenol	0·090
o-Cresol	0·038
m- ,, ...	0·035
p- ,, ...	0·055
p-Chlorophenol	0·020
p-Nitrophenol	0·000
Pentachlorophenol	0·012
Salicyclic acid	0·020
Phenol *p* sulphonic acid	0·250
p-Toluene sulphonamide (sodium salt)	0 150
o-Hydroxydiphenyl	0·008
o-Hydroxyacetophenone	0 050
p- ,, ..	0·150
p-Hydroxyphenyl benzyl ketone ..	0 025
"Shirlan"	0·010
"Preventol"	0 002
Sodium anacardate	0·100

experiments are along parallel and complementary lines, leading to no duplication of effort.

R. C. GANDHI.
K. VENKATARAMAN.

Department of Chemical Technology, The University, Bombay,
August 7, 1939.

[1] Venkataraman, *Curr. Sci.*, 1939, **8**, 282.

[2] Pillay, *J. Indian Chem. Soc.*, 1935, **12**, 226, 231; *Proc. Ind. Sci. Cong.*, 1938, 59.

[3] Uppal, *M.Sc. Thes. Univ. of the Punjab*, 1935; Uppal and Venkataraman, *J. Soc. Dyers Col.*, 1937, **53**, 91, *et sequa*.

[4] Forster, Uppal and Venkataraman, *J. Soc. Dyers Col.*, 1938, **54**, 465.

[5] Evans, *Ibid.*, 1935, **51**, 233.

[6] Forster, Uppal and Venkataraman, *British Patent Application* No. 34810 of 1937,

[7] Uppal and Venkataraman, *J. Soc. Dyers Col.*, 1939, **55**, 125.

[8] *Cf.* Ramachandran, Uppal and Venkataraman, *Ibid.*, 1938, **54**, 520.

[9] Adams and Holmes, *J. Soc. Chem. Ind.*, 1935, **541 T**; *Brit. Pat.* 450, 308; *U.S. Pat.*, 2, 104, 501; *I. G. Farbenindeutrie, Brit. Pat.*, 489, 173.

[10] Burrell, *Ind. Eng. Chem.*, 1938, **30**, 358.

[11] Forster, Gandhi and Venkataraman, *Proc. Ind. Sci. Cong.*, 1939, 91.

[12] *Cf.* Morris, *J. Text. Inst.*, 1927, **18**, T 99; Fargher, Galloway and Probert, *Ibid.*, 1930, **21**, T 245.

[13] Nadkarni, *Indian Materia Medica*, p. 59.

[14] Patel, *J. Ind. Chem. Soc., Indl. Edn.*, 1939, **2**, 112.

Nitrite Estimation in Compost and Soil Extracts

THE object of this note is to bring to the notice of workers in the field of agricultural and biochemistry a comparatively simple and accurate method of nitrite estimation which is still unknown to many. The method was first described by Sanin[1] in Russia. The obscurity of the method is apparently due to its publication in a Russian journal which is available only to a few. A reference to the method without details, except the main reaction involved, is to be found in *Industrial and Engineering Chemistry*.[2]

Methods of nitrite estimation can be ordinarily classified under two heads, (1) colorimetric methods; (2) oxidation methods. There is also a standard gasometric method described by Treadwell and Hall.[3] This method, although accurate, is tedious and expensive. Both colorimetric and oxidation methods are inapplicable to composts and soils because of the colour and dissolved humic bodies in their extracts.

The method under notice which appears to be most suitable for coloured and humic extracts, was worked out in these laboratories and found to be satisfactory even with highly coloured extracts of composts. The only precaution necessary for coloured extracts was to dilute them to an extent which would facilitate a determination of the end point in the titration. Dilution does not affect the accuracy of the result. When a translation of Sanin's paper was obtained through the courtesy of the Imperial Bureau of Soil Science it was found that the details worked out here tallied with those given by him.

The method is based on the interaction between nitrite and hydroxylamine hydrochloride. The two reagents react rather slowly and even a prolonged contact for one hour does not give the true value, although the reaction stabilizes itself at the end of that period. Heating to about 80° C. hastens the reaction and at the same time removes nitric fumes which were found to interfere with the estimation. The reaction takes place according to the following equation

$$NH_2OH \cdot HCl + NaNO_2 = NaCl + N_2O + 2H_2O.$$

Even though the equation does not suggest the presence of nitric fumes, still every interaction is followed by the smell of nitrogen peroxide presumably due to the decomposition of small amounts of nitrous acid which is the intermediate product in the reaction. This may partly account for the slightly low recovery of nitrite upto 25 mg. and at the same time may roughly act as a guide to the presence or absence of nitrite in the sample.

Following the decomposition of the hydroxylamine hydrochloride the acidity of the solution diminishes and the titration then simply becomes an acidimetric and alkalimetric one, the successful end of which depends upon the use of a proper indicator.

The acidity of the hydroxylamine hydrochloride solution is determined by titration with a standard solution of caustic soda before and after the reaction with nitrite with phenolphthalein as the indicator. The difference between the volumes of caustic soda gives the amount of hydrochloric acid used up in displacing the nitrogen from nitrite.

10 c.c. of nitrite (5 gm. to a 1000 c.c. accurately weighed) are pipetted into a conical flask containing 10 c.c. of NH_2OH-HCl solution (10 gm. to a 1000 c.c. approximately) and the flask is heated to about 80° C. until the evolution of the gas ceases. Heating to boiling gives no advantage. The flask is then cooled and the contents titrated against 0·05 N caustic soda. The alkali equivalent for 10 c.c. of NH_2OH-HCl is previously determined. The difference between the two titrations is a measure of the acid used up in decomposing the nitrite and hence is a measure of the quantity of nitrite.

Weaker and stronger alkali upto N/10 can be used depending upon the amounts of nitrite and the individual's ability to observe the end point correctly. One drop of N/20 NaOH gives a sharp end point whereas it was not so with N/50. Weaker titres will no doubt increase the accuracy, provided the end point is properly judged.

The calculation is made according to the following formula:

$$\% \text{ Nitrite} = \frac{a \times b \times 69 \times 10}{40 \ S}$$

where a = c.c. of alkali for the whole of the sample S.
b = titre of the solution of alkali.
69 = molecular weight of sodium nitrite.
40 = molecular weight of sodium hydroxide.

Several compost extracts of various colour intensity were tried with this method with satisfactory results. Highly coloured extracts were suitably diluted and used for analysis. Known amounts of nitrites were added to composts and their extracts analysed. The recovery was as follows:—

Recovery of Nitrite added to Composts

$NaNO_2$ added	$NaNO_2$ recovered	Per cent. recovery
25 mgm.	24 84 mgm.	99·3
50 ,,	50·70 ,,	101·4
100 ,,	102·10 ,,	102 1

Hydroxylamine hydrochloride and other solutions can be safely stored over fairly long periods without any need of restandardization. The method is simple, economical and rapid.

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[1] *J. Russ. Phy. Chem. Soc.*, 1909, **41·1**, 791.
[2] *Ind. & Eng. Chem. Anal. Ed.*, 1933, **5**, 112.
[3] *Analytical Chemistry*, 1924, **2**, 700.

REVIEWS

Theoretical Electro-Chemistry. By N. A. Mckenna. (Macmillan & Co., Ltd., London), 1939. Pp. xiii + 469. Price 15*sh.* net.

The theory of inter-ionic attraction put forward by Debye and Hückel in 1923 and extended by Onsager in 1927, has led to a new orientation of our ideas with regard to the state and behaviour of ions in solution. The early successes attending the application of this theory to the process of electrolytic conduction have been followed up by further successes in other fields, in recent years, with the result that the theory is now capable of explaining almost all the properties of dilute ionic solutions, both reversible and irreversible. These developments make it incumbent on every student of theoretical chemistry to get himself fully acquainted with the theory of inter-ionic attraction and its applications at a relatively early stage of his specialised studies. The book under review will enable him to do so.

The book opens with a chapter on historical introduction to electro-chemistry, which gives a clear and lucid account of the development of the subject. This is followed by a chapter on fundamental electrical measurements, dealing with the measurement of electric current and potential difference. In the next chapter, the author introduces the general theory of conductivity, describes the methods of measuring the conductivities of solutions in detail and discusses the experimental results in the light of the inter-ionic attraction theory. The change of conductivity with frequency and increasing field strengths and the conductivities of non-aqueous solutions are also discussed at length. The two succeeding chapters deal with the other irreversible properties of ionic solutions, such as mobility, transport number, viscosity, diffusion and surface tension. The next chapter contains an outline of the principles of chemical thermodynamics and their applications to solutions. This serves as an introduction to the succeeding three chapters which deal respectively with the thermodynamical or reversible properties of strong electrolytes (osmotic pressure, solubility effect, etc.), the electrode processes and reversible cells. The topics discussed in the remaining chapters include polarisation, over-voltage, the effect of ions on the solvent molecules, ionic equilibria, hydrolysis of salts and the theory of indicators.

The book is written in a clear style throughout and is well produced. References to original literature make it a valuable guide in the advanced study of the topics discussed. It is believed that the work will prove very useful as a text-book for the university students working for the degree examination.

M. QURESHI.

Spontaneous Fluctuations of Voltage due to Brownian Motions of Electricity, Shot Effect and Kindred Phenomena. By E. B. Moullin. (Clarendon Press, Oxford), 1938. Pp. 251. Price 17*sh.* 6*d.*

The book deals with a class of phenomena which have come into prominence with the development of high gain amplifiers. In fact these phenomena came to be noticed and studied on account of the residual noises in such amplifiers, and can be studied only through their intervention. These noises were found to depend largely on the nature and the condition of the elements present in the grid-filament section of the first valve of an amplifier. The scale of the effects is very small, as in the case of Brownian movements, of which they are counterparts, and they could not have attracted attention by themselves, without the magnification available through the amplifiers.

Since their first discovery, a great deal of experimental and theoretical work has been done on the subject by a number of scientists, among whom may be mentioned J. B. Johnson, F. C. Williams, H. Nyquist, N. R. Campbell, W. Schottky and the author, E. B. Moullin, to mention only a few. The author writes with first-hand practical knowledge and subjects the material available, both theoretical and experimental, to a searching and critical analysis. He takes a cautious attitude where insufficient knowledge of the factors makes such an approach necessary. His attitude is that of a vigilant pioneer taking us through the intricacies and doubts that yet beset a study of the phenomena. Contributions by various workers in the field are fully recognised and references

are given to the original papers. Tables of results, graphs and diagrams are freely reproduced.

Coming to the treatment of the subject, the author starts with observations on the Kinetic Theory and the equipartition law, showing how this law could be applied to the fluctuations of charge or current in electric circuit elements. Experiments are described justifying such application. Expressions for mean square values of thermal fluctuations of voltage are derived and examined in the light of experimental results. Shot voltage in thermionic tubes is next dealt with, both in temperature limited and space charge limited cases. It is shown that where the thermal fluctuations and shot effects coexist, they produce their results more or less independently.

Two chapters are devoted to a close scrutiny of the working of a diode, under both temperature limited and space charge limited conditions of current, and a search is made to connect the shot effect with the thermal fluctuation effect. Interesting results arise, such as that the shot effect in a diode corresponds to the thermal effect in a resistance equal to half the valve resistance at half the cathode temperature. A critical analysis of the work of different authors is to be found here.

This is followed by similar analysis in the case of triodes and multielectrode valves under different conditions of partition of the electron stream by varied interconnection of electrodes. Chapter six deals with the phenomena of the "flicker effect" at low frequencies, the "ionisation effect" depending on presence of positive ions, and phenomena arising from "secondary emission". The last chapter deals with certain technical problems involving fluctuations, such as action of rectifier on fluctuation voltages, signal to noise ratio in coupled circuits, thermal fluctuation in cables, effects arising through vacuum photoelectric cells, "crazy contact" effects, and limitations to galvanometer sensitiveness. An appendix deals with a few papers published after the material had been sent to press.

On the whole the book is a very thorough exposition of a most complicated subject, and deserves the attention of all who are interested in electrical communication.

A. V. TELANG.

Grundzuge der Theorie ungesattigter und aromatischer Verbindungen. By Prof. Dr. E. Hückel. (Verlag Chemie, G.m.b.H., Berlin), 1938. Pp. 160. Price 6 RM.

Several chemists watch with helpless amazement the rapid inroads of the physicist with his new fledged mathematical tools, into even the favourite fields of organic chemistry. Indeed, without a considerable effort, one feels it almost impossible to follow the "geheimsprache" or code language of this new race of "quantum chemists". And yet, not even the orthodox organic chemist revelling in purely synthetic work, can feel at ease without some acquaintance with the modern developments in what may be called the fine structure of the electronic constitution of organic molecules. In particular, it is interesting to note that the striking physical and chemical properties of unsaturated and aromatic compounds are being tracked down both qualitatively and quantitatively in terms of the quantum theories.

Various attempts have been made to present these developments in a non-technical language and the booklet under notice can easily be classed as one of the successful variety in this direction. It is actually only a reprint of a *Sammelreferat* originally published in the *Zeit. f. Elektrochemie*, but the present publication in a separate booklet form will make the subject-matter more easily accessible in college libraries. In this book after a description of the pair and orbital methods of approximation to the energy of polyatomic molecules, the author deals with free radicals, and the characteristic reactions of several compounds. The limitations of the applications of the modern theories in the present form, are not underestimated, and the book serves on the whole to convey to the readers for whom it is meant, a clear picture of the modern achievements, and perhaps also of the future possibilities.

M. A. G. RAU.

Electricity Meters and Meter Testing. By G. W. Stubbings. (Chapman & Hall, Ltd., London), 1939. Pp. 216. Price 12*sh.* 6*d.*

At the present time when the laws governing the supply meters in India are being reshaped, this book comes at a very opportune moment. It deals with the subject of

meter testing in the light of the legislation introduced in the British Isle in 1936.

The book opens up with a chapter dealing with economic aspects on which various charging systems are based and gives a brief but masterly summary of the rationale of energy costing. A brief description of the various types of meters in use is followed by the discussion of methods of measurements and errors of measurements. Chapters dealing with standard and sub-standard instruments for use in the testing laboratories and laboratory equipment appear at places to be unduly detailed, since a large portion of the material dealt with in these chapters could be found in most text-books on electrical measurement. The chapters on methods of measurements and recording and of analysis of results is particularly interesting.

Mathematics has been used sparingly. It is felt that electrical engineers, in general, would prefer to have the theoretical aspects dealt with in terms of mathematical symbolism rather than have it elucidated "by verbal explanations from first principle". Mathematics, for an electrical engineer of to-day, is no more a bugbear, but the language in which he can express himself with exactitude.

The book would have acquired a greater value, had the subject-matter of design and construction of various types of meters been dealt with in a greater detail. The short list of references to books and papers, included at the end of the book, hardly justifies the editorial policy of the monograph series of which this book forms a part. Detailed references to current literature scattered throughout a book like this would enable the reader to follow up any aspects of the subject to a greater extent if so desired.

The book as it stands would, no doubt, prove useful to practical engineers who are concerned mainly with the testing of meters.

A number of typographical errors appearing throughout may, it is hoped, be corrected in the subsequent editions.

LAL C. VERMAN.

The Theory of Complexity and of Allotropy. By Professor Dr. A. Smits. (Verlag Chemie, G.m.b.H., Berlin), 1938. Price RM. 19·50.

Professor Smits's work on the complexity of phases and transformation and allotropy of phases is well known to all students of chemistry. In the present book Professor Smits gives an up-to-date exposition of his theory of allotropy and of the complexity of phases in the form in which he has developed it since his first publication on the subject. He discusses exhaustively the experimental evidence in support of his views. The book will be found very suggestive and useful to all who are interested in the complexity of phases.

J. C. GHOSH.

Aircraft Design. By C. H. Latimer Needham. (Chapman & Hall, Ltd., London), 1939. Vol. I—*Aerodynamics*. Pp. viii + 228, 144 figures. Price 13*sh*. 6*d*. net; Vol. II—*Aerostructures*. Pp. viii + 314, 160 figures. Price 16*sh*. net.

This book, in two volumes, is by a well-known authority on aeroplane construction, who has had wide experience in aero work in all its branches, piloting, teaching, design and construction. The first volume is entitled "Aerodynamics" but it is not devoted exclusively to the abstruse mathematical theory which that term is usually taken to denote; throughout the volume are numerous descriptions and practical applications of the aerodynamic laws. Aerodynamics in the restricted sense may be assumed to comprise such subjects as air flow, lift, properties of aerofoils, flight stability and airscrew theory, but in addition to this the volume contains a great deal of matter on the practical application of the fundamental theories such as arrangement of lifting surfaces, control systems, slotted wing and other devices, aeroplane performance, with valuable and interesting design figures on such matters as dynamic loading.

The second volume deals with the design proper of the structural parts and of the auxiliary parts such as the undercarriage and the control system. It also contains, necessarily, chapters on the materials of construction and their properties, properties of structures as well as a chapter each on the power unit, seaplanes and flying boats and the testing of aircraft materials and components.

The tone of the whole book is very practical, design data and concrete figures relating to subjects under discussion being given throughout, which practice always has a

strong appeal to any engineer in any branch of the subject. While the book will be keenly appreciated by engineers and students who are engaged professionally on aircraft work, it will also have a wider appeal to a large number of people who are prompted merely by intellectual interest to learn something about this fascinating subject, and the greater part of this book can be read with interest by those who have only a limited knowledge of mechanics.

K. ASTON.

Photochemical Reactions. (1) The Determination of the Mechanism of Photochemical Reactions. By Phillip A. Leighton. (Hermann & Cie, Paris), 1938. Pp. 72. Price 18*fr.*; and (2) The Photochemistry of Halogens. By G. K. Rollefson. (Hermann & Cie, Paris), 1938. Pp. 53. Price 20*fr.*

These valuable publications issued under the direction of Dr. W. A. Noyes Jr., give an authoritative exposition of the current position on photochemistry and are particularly valuable to those engaged in allied fields of research. The introductory chapter in the monograph on the mechanism of photochemical reactions, is devoted to the determination and interpretation of quantum yields and a general treatment of photochemical kinetics. In the later chapters the photo-decomposition of ammonia and of hydrazine, the photochemical synthesis of ozone and the reactions involving the halogens and the $C = C$ bond are treated in detail with a view to illustrate the methods used and the problems encountered in determining the nature of the over-all mechanism of photochemical reactions.

The second monograph deals, in detail, with the nature of the activating influence of light on the halogens in the gaseous state and in solution. The reactions of the halogens with hydrogen and carbon monoxide as well as the well-known substitution and addition reactions are discussed. A few typical sensitised reactions are dealt with and it is shown that the so-called sensitised reactions are in reality very complex mixtures of reactions. A discussion of the role of moisture in the photochemical combination of hydrogen and chlorine would have added to the usefulness of the publication.

K. S. G. D.

The Soils of the Lusitano-Iberian Peninsula (Spain and Portugal). By Emilio H. Del Villar, President of the Mediterranean Subcommission of the International Society of Soil Science; translated into English by G. W. Robinson, Professor of Agricultural Chemistry, University College of North Wales, Bangor. (Sole Publishing Agents for all countries except Spain: Thomas Murby & Co., 1, Fleet Lane, London, E.C.4), 1937. Pp. 416. Price 40*sh.*

The above book is published in the series "The Soils of the World". The translator, in his Preface, says that this book has an importance which reaches beyond the boundaries of the region with which it deals and that it is an important contribution to the problem of soil classification and further that it must inevitably modify current ideas on soil genesis and classification. The truth of these words are fully borne out by a careful study of the book.

The classification used in the book is fundamentally the objective system which was presented by the author to the Second International Congress of Soil Science (Leningrad, Moscow) only in that it has been modified to some extent for the sake of greater amplification. According to this system, soils are classified by their own characters of stratigraphy, composition, and metabolism, taking as basis those factors which most directly affect the vegetation, namely, soluble salts, importance of the sodium ion in the absorbing complex, presence or absence of calcium carbonate, character of the humus, proportions of silica and sesquioxides in the mineral colloidal material, and the medium (aerobic or submerged) in which metabolism takes place. The soils have been classified into hydropedic, saline, alkaline, calcareous, allitic, acid-humic, siallitic, alluvial, and Gley series or grouping further into saline-alkaline cycle, calcareous cycle, sesquioxide cycle, and hydropedic cycle. Dr. Villar recognizes that when soils are classified under this system, some soils cannot, in many instances, find place under any head and says appositely that "In the natural sciences, divisions are human devices; whilst nature is continuous".

In his description of the soil types and classification on the basis of his system, Dr. Villar again and again finds cause to call

into question the older systems of classification. Thus regarding *podsol* he says, "I do not consider *podsol* 'stricto sensu' as a systematic division of the first order, but as an accentuated stage within a type of series, whose general character is unsaturated humus and not the occurrence of a podsolized horizon. Podsol should therefore be a division of acid-humic soils," again "Russian and German authors have termed podsol a zonal soil since it appears to be such in their countries. In the Peninsula, the acid-humic soils appear to be conditioned not so exclusively by the climate as by the parent material. This is one of the reasons for believing that zonality is not a proper character of soils but a geographical result, and should not therefore, be used as a basis of classification." He dismisses the division Ramann's Braunerde 'brown forest soil' as ambiguous. "In my objective system these expressions are rejected as ambiguous, since there exist forest soils and brown soils of essentially different character." Regarding Terrarossa he says, "Within the siallitic series there are also red soils which, in the Peninsula, as in other countries, have often been confused with Terrarossa. Terrarossa belongs to the calcareous series. Reifenberg has shown that the red colour is due to iron oxide peptized by colloidal silicic acid. His proof refers only to calcareous soils. But since colloidal silicic acid and not (calcium) carbonate is the effective factor in the phenomenon, I believe that explanation is equally applicable to siallitic soils, which, when their leaching metabolism is not very intense, contain also high proportions of colloidal silicic acid without necessity for the presence of carbonates to favour coagulation." Regarding the origin of saline soils what he says is of particular interest to certain portions of India, and detailed examination of profiles may show the cause of formation to be similar. Thus "The salt marsh areas of the interior (Spain) have not, as has been supposed from superficial study for half a century, a regional extension and do not result from general hydrological and climatic factors, namely, transport by water to depressions and lower levels of salts dissolved from surrounding lithological materials, and capillary rise of such salts, followed by their accumulation in superficial crusts owing to the intense summer evaporation. The actual saline patches in Spain are local phenomena of deep-seated (geological) origin, occurring with frequency in certain areas for this reason and *generally independent of the regional lithology*. In their formation climate plays a passive rôle, by not permitting the removal of salts by leaching as would happen in countries with less evaporation and more abundant rainfall. Where salinity tends to be more general it is due not to different causes, but to the longer or more intense operation of the same cause" and again later "But the antecedent fact of the formation of lithological materials capable of yielding soluble salts to leaching waters can only be attributed to deep-seated causes. The impregnation phenomena belong to the past; the activity which produced them has now ceased; and the saline lithological materials only play a passive rôle in providing leachable materials". " ..... climate then, is not the effective agent of saline formations. Its rôle is passive without ceasing to be important. In less arid climates the salts brought in by geological causes would have been subjected to leaching which would have prevented their accumulation. This is not peculiar to Spain and the explanation is of universal application. Thus in all parts of the world where there is a conjunction of tectonic depression with arid climate, saline soils are formed."

Prof. Emilio H. Del Villar in the epilogue to the above book quotes from his own book *El Suelo* thus:—

"A cultivator who does not know his own soil is like a business man who is ignorant of the capital with which he works" and continues "That which may be said of private affairs is true of public affairs. Without knowledge of the soils of a country and their distribution there is no possibility of intelligent agrarian policy in the present state of culture..... The soil map is therefore one of the fundamental necessities of a country. The more so since the study of the soils by modern methods is an expensive work which, by the great majority of workers, cannot be conducted privately. The maximum detail can only be obtained on large-scale maps, *e.g.*, 1:50,000 or 1:100,000 which would require an amount of work in exploration and mapping of boundaries only possible with numerous workers and abundant financial support."

How unlike our country where reduction in financial grants and retrenchments are the order of the day. To all who are interested

in the well-being and prosperity of our country, the preparation of a soil map at least as good as the one prepared by Emilio H. Del Villar for his country must necessarily become of paramount importance and significance.

The book consists of 416 pages of well-printed matter in bold type and is practically free from typographical errors, has 87 tables of analysis and 28 photographs of profiles, etc. It is accompanied by a coloured soil map on the scale 1:1,500,000.

N. G. CHOKKANNA.

Soil Analysis. By C. H. Wright. (Thomas Murby & Co., London), Second Edition, 1939. Pp. 276. Price 12*sh.* 6*d.*

This book is the second and revised edition of the book published by the author about five years ago. The new edition contains the same divisions into three chapters as the first edition, devoted to physical methods, general chemical methods and special chemical methods, but many of the older and less important methods have been omitted and room has been found for some new methods such as those dealing with freezing point, glass electrode, antimony electrode, inorganic soil colloids and the determination of zinc and cobalt in soils. The portions dealing with nitrogen and carbon estimations have been amplified and enlarged. The portion on the mechanical analysis of soils has been revised keeping in view the recommendations of the International Society of Soil Science in regard to preliminary dispersion of the soil. Fairly full working details of the several methods have been given. The book will be a useful addition to the library of soil analysts to whom it should form a useful laboratory companion.

B. VISWA NATH.

Text-Book of Dendrology. By William M. Harlow and Ellwood S. Harrar. First Edition. (McGraw Hill Publishing Co., Ltd., London), 1937. Pp. xii + 527; 224 illustrations. Price 25*sh.*

The field covered by the book is described in the subtitle as "Covering the important forest trees of the United States and Canada". And in the treatment of the subject, the authors have had in mind the rather specialised requirements of the forestry student whose profession, while demanding a knowledge of the important trees all over the country does not, at the same time, necessitate the elaborate taxonomic knowledge of each individual species as required by a pure Botanist.

It will thus be seen that the authors set themselves, both in the theme and in its elaboration, well-defined objectives. They have admirably succeeded and have produced a text-book likely to be the standard work on the subject for forestry students and a pattern on which similar books should be modelled for other regions. What a boon it would be if a comparable text-book could be produced to embrace Indian forest species!

The "Text-Book" is provided with an Introduction giving in broad outline the aim and methods of the sciences of dendrology and taxonomy. The authors, instead of pedantic discussions on such distinctions as "Trees" and "Herbs" adopt the more useful if less exact borderlines of practical utility to the forester. The introduction is followed by sections on "Gymnosperms" and "Angiosperms". Each species carries an account of its "Distinguishing characteristics", "General Description", "Range" (again a concession to the forestry student) and "Botanical features". The text is illustrated with unusually good photographs bringing out all the essential detail (the photograph on p. 297, Fig. 129—Fruit and leaves of beaked Hazel nut × ¾ is typical of the excellence of the reproduction). A modest Glossary, some "selected References" and a good "Index" have been provided. (It is noticed that the term "appressed" frequently used in the text fails to find mention in the Glossary.)

The *Text-Book of Dendrology*, although dealing with species largely exotic to India would be a useful addition to the Forest and Botanical Sections of our Libraries as it would also be of special interest to those engaged in the comparative Taxonomy and Dendrology of forest trees. The book is a worthy addition to the "American Forestry Series" and the authors as well as the publishers are to be congratulated on maintaining the high standard set up by the earlier numbers of the series.

M. N. R.

The Plant Alkaloids. By T. A. Henry. (J. & A. Churchill, Ltd., London), 1939. Pp. 689 + xvi. Price 42*sh.*

The third edition (1939) of this well-known treatise on the chemistry of the plant alkaloids is a most welcome addition to

scientific literature. The book is divided into thirteen chapters and the index is helpfully complete. Since the publication of the second edition (1924) the investigation of alkaloids has progressed with great vigour, resulting in the creation of a vast amount of knowledge. To do justice to this and at the same time to avoid the book developing into a bulky volume, details about the estimation of alkaloids and pictorial illustrations have been deleted from this edition. An important omission in the subject-matter is the discussion on the purine group, and however justifiable the omission may be from the point of economy of space, one misses it very much.

The structure of many alkaloids are known with certainty and a good many of them have been synthesised. The analytical development is very carefully and concisely described and all the well-known syntheses are described in a helpful manner. The methods developed by Schopf and Hahn for the synthesis of alkaloids under conditions approximating to those existing in the living plant are described in general in the introductory chapter and in greater detail in the text.

With the synthesis of nicotine it was assumed that tobacco would provide no more thrills, but the work of Spath and his collaborators has shown that tobacco contains a number of subsidiary alkaloids. The chemistry of lupinine is fully described, and reading through these pages gives the conviction that since the groundwork has been so skilfully cleared by Clemo and his collaborators, the alkaloids of Senicio, Trichodesma and Helitropium, now grouped under alkaloids of unknown constitution, may soon be shifted to a place higher up.

The reviewer cannot help remarking that the formulæ are printed in a manner which is not very attractive. Trying to economise space by adopting the present method of printing formulæ has resulted in ambiguity in certain places. For instance on page 316 the amino-group in tetrahydro-*iso*-quinoline (Formula 5) is printed as part of the ring. Apart from such very minor defects the book is very clearly printed and attractively bound. There is no doubt that every library should possess a copy and no worker in the field of alkaloid chemistry can afford not to own a copy. B. L. MANJUNATH.

Intermediate Solid Geometry. By Brij Mohan. (Mohan & Co., Muradbad), 1938. Pp. 120. Price Re. 1–4–0.

The book is intended for the use of students studying in the Intermediate class and the treatment of the subject is not very different from that in *Hall and Stevens' School Geometry*, Part VI. The author claims to supply the long-felt need of supplementing every proposition with a variety of examples, the working of which is necessary for every student to get a clear conception of the subject. While the insertion of a certain number of theoretical exercises under every proposition has certainly added to the novelty of the book, the almost complete omission of numerical exercises in the beginning is not, after all, a very happy feature. A good number of numerical exercises, even before the commencement of the treatment of solids, ought to have been introduced to familiarise the student with, for example, the ideas of (i) angle between two planes, (ii) a line and a plane, etc., which occur very frequently in mensuration. A novelty in the arrangement of propositions could also have been welcome—the theorems on parallels might have preceded the theorems on perpendiculars. While dealing with the chapter on Sphere, ideas of latitude and longitude could also have been given clearly before attempting exercises demanding their knowledge. Barring some of these drawbacks from which not many books are free, the book can conveniently be used for teaching in Intermediate classes. N. R.

Trigonometry. By Hughes and Muller. (John Wiley & Sons, New York; Messrs. Chapman & Hall, Ltd., London). 1938. Pp. 189 + 79. Price 7/6.

This attractive, excellently got-up textbook will be welcomed by the beginner of Trigonometry as a very useful introduction. More importance is given here to the numerical aspect of the subject than is done in the usual text-books. We believe, with the authors, that the student will interest himself more in the subject by being introduced to the immediate applications of the formulæ he learns than by mere pursuit of the theory. The chapter on the Spherical Triangle and the Logarithmic and other Tables at the end admirably serve the purposes for which they are intended. B. S. S.

The Evolution of the Text-Book

Introductory College Physics. By Blackwood. (John Wiley & Sons, Inc., New York, Chapman & Hall, London), 1938. Pp. 47. Price 17*sh.* 6*d.*

TO be called upon to review an elementary text-book is at once an easy and a difficult task. It is easy, if the conventional short notice is all that is required. One studies the table of contents, occasionally glancing at the book itself to see how the familiar subject-matter is presented. One may actually read a chapter here and there to discover whether the author has a reasonable style. Consideration is given to the printing, binding, and (last but not least) the published price, after which the reviewer, according to his taste in text-books, either solemnly warns the scientific public against the pernicious influence of the work in question, or commends it to them as a shining example of what a text-book ought to be.

It may be observed first of all that the volume now under review passes such tests as these. It is to all appearances the work of a diligent and able author, excellently produced by the publishers, and, considering everything, not unreasonably priced at 17*sh.* 6*d.* But one is tempted to take the opportunity of enquiring a little more deeply into the whole matter. What, after all, is a "text-book", and by what canons of judgment should it be appraised? This is a difficult question to answer, but text-books are in many ways so important that it is worth taking a little time to consider such a singular by-product of the modern age.

The scientific text-book must be classed as a relatively modern development, belonging to the past century or so. In the early days of science there were no text-books to mediate between the mind of the creative thinker and that of the student. The student learned directly from the teacher to whom he attached himself, or from the writings of the masters, which were in no sense text-books. Lucretius' *De Rerum Natura* is not a text-book, neither is Galileo's *Dialogue on the Two Chief Systems of the World*, nor Newton's *Opticks*, nor Faraday's *Experimental Researches*. Even Maxwell's *Treatise on Electricity and Magnetism* is not a text-book in the modern sense of the term. These works are rather store-houses, containing wisdom and knowledge which the author has garnered over a long period of years. They record the author's mind, and are not primarily manuals of instruction for the student. Treasures are gathered in from every quarter with evident enthusiasm. Thus Maxwell, in 1855, writes to William Thompson: "I do not know the Game-laws and Patent-laws of science. Perhaps the Association may do something to fix them but I certainly intend to poach among your electrical images".[1]

These works, and others like them at the present day, are, in the truest sense of that much-abused word, 'literature', and are of permanent value. The text-book of modern days is usually not literature and does not pretend to be. The material is mostly second-hand, selected, often enough, to agree with an external and ill-assorted list of topics known as a syllabus, and, most baneful of all, it is too obviously 'intended for' someone. True literature is not 'intended for' anyone. One cannot imagine on the title-page of 'Hamlet'—"Intended for students of the Inter Arts", however much the hack commentator, who lowers Shakespeare's greatness to a level suitable to our intelligence, may wish it there.

The text-book writer, therefore, necessarily works against great odds. He cannot follow his fancy, nor, often, his better judgment. He must consider his work as a commercial proposition. He is in the market with his wares and they must be saleable. If the public prefers hoary fallacies, the truth will be unpopular, and must either be avoided or suitably disguised. He must remember that his reviewers may be staid and old-fashioned, but their words will be weighed in gold. If he wants his book to sell, particularly in an examination-ridden land like India, the book must contain the syllabus, the whole syllabus, and nothing but the syllabus. His illustrations must be the official illustrations, his definitions the inaccurate formularies honoured by long usage. Otherwise ponderous professors will write to him: "Your book is of no use to me, it does not cover the syllabus, you have not distinguished the three kinds of lever". The whole stock-in-trade of traditional scientific pedagogy must be there, and nothing else.

And so it comes about that India at the

[1] *Origins of Clerk Maxwell's Electrical Ideas*, Larmore, p. 18.

present time is flooded by books which do cover the syllabus, but which ought themselves to be covered by six feet of good earth. For this reason we do well to examine books which come to us from abroad, such as this *Introductory College Physics* by Professor Blackwood of Pittsburgh. One gets the impression that the evolution of the text-book has entered on a new and more interesting phase in recent years. There is evidence of a change of purpose. The older text-books, even the good ones, were dry and dull compendiums of information. The newer kind seek to stimulate the student's interest and enthusiasm, and are sedulously careful not to quench any spark of natural curiosity which the student may still retain. Professor Blackwood is an enthusiast for the new method, and indeed remarks: "The first requirement of such a course is that it shall stimulate the interest of the general student". Maxwell would have agreed with this; when he began Electricity he wrote to Thompson: "Suppose a man to have a popular knowledge of electrical show experiments and a little antipathy to Murphy's Electricity, how ought he to proceed in reading and working so as to get a little insight into the subject....?"[2] The objectionable Murphy has passed into the limbo of forgotten things, but his successors are still with us.

Here, then, is a criterion of judgment. Does the book interest, stimulate, and inspire? This is of infinitely more importance than the table of contents, and several recent publications come to mind which are admirable when judged by this criterion. The thing is achieved in a variety of ways. Firstly there is a wealth, some might say a superfluity, of illustration. On page 61, Prof. Blackwood has the old problem of the monkey hanging on a rope, which passes over a pulley, the monkey being balanced by an equal weight on the other end of the rope. What happens when the monkey climbs the rope? This engaging problem is accompanied by a life-like delineation of the monkey himself, solemnly contemplating his image in a mirror. One may not admire the monkey, but one cannot help admire the enthusiasm which put him there. And so throughout the book everything is illustrated that can be illustrated, and many of the diagrams and photographs are admirably suited to their purpose.

The second way of arousing interest is to look for the applications of physics not so much in the time-worn examples of the older writer but in things more closely related to the life of to-day. So the automobile (more familiar to us as a 'motor car') is pressed into service to provide an almost unlimited number of illustrations in all fields of Physics. The clutch and brakes illustrate friction, the transmission and the gear box make clear the principles of mechanics. The engine is an excellent piece of thermodynamics, and most of what a student needs to know about electric currents is exemplified in the ignition system. Even optics finds applications, as in the use of polaroid discs to avoid glare. Another such example is that of the refrigerator, which illustrates the conditions governing the transfer of heat. The treatment in this instance, though brief, is particularly clear and instructive.

The third development, likewise exemplified in this book, is that the author permits himself (to borrow a phrase of Eddington's) to talk "more or less like a human being and not like an Act of Parliament". The sterner critics of an earlier age would have regarded this as an unpardonable lapse. Undoubtedly it can be over-done, but dignity of language is not incompatible with freshness, and even vivacity. So, comparing the common and scientific notions of work, Prof. Blackwood remarks: "A golf caddy is 'working' when he stands idly while the perspiring player tries to hit a golf ball". One feels that Murphy, to whom Maxwell conceived such an antipathy, would never have permitted himself such a sly remark. But it makes the book live for all that. The language throughout is clear and vigorous, but one may perhaps note that the American idiom occasions difficulties now and again to the foreigner. The Indian student might be puzzled to know who the ten 'sophomores' are who apply a force to a rope on page 11. And, to the uninitiated, a pleasing flavour of mystery attaches to such a problem as "In knocking out flies, a baseball's speed changed from 0 ft./sec. to 80 ft./sec. in 1050 sec. What was the average acceleration?" One wonders for a moment what the flies have to do with it.

In conclusion, one or two criticisms may be permissible. One would like to see the hackneyed phrase 'mass is the quantity of matter in a body' die out entirely, especially as it happens to be untrue. In his treatment of specific gravity, Prof. Blackwood very properly recognises the distinction between

[2] *Origins of Clerk Maxwell's Electrical Ideas*, Larmore, p. 3.

specific mass or density, and specific weight or weight per unit volume. The latter he terms weight-density, or (in a footnote) weightivity. Surely it would be better to use the term specific gravity itself in its proper sense of weight per unit volume. By this means extra nomenclature is avoided, and a long-standing confusion is removed. German writers (Westphal, Tomaschek, etc.) already follow this practice, but the dead hand of tradition still keeps it out of the English books.

A further criticism might be that in ranging over the whole field of Physics, including very recent work, the treatment is often rather summary and sketchy. The answer is, of course, that an exhaustive treatment is not intended. One cannot blame a book for not being something which it does not pretend to be. Still, it is undoubtedly overconcise in places. There is also a distinct tendency for new ideas to slip in without proper definition, merely on the strength of some analogy, and a little more exactness at these points would not be incompatible with the purpose of the book. Torque, Rotational Inertia and Electrical Resistance are examples of this.

There are one or two small errors of fact, and a few printing errors, which perhaps are almost inevitable in a first edition.

When all such criticisms have been made, it remains true that the book is an admirable introduction to Physics, for all except those whose heads are buried in the sands of tradition. But whether it is likely to be read much in India is open to considerable question. For the students in our universities, alas, read for the most part only what is prescribed, and a book which has such a flavour of originality is unlikely, one fears, to be brought to the notice of those who need it most.

H. J. TAYLOR.

Theory of Statistical Estimation

THE fundamental stages in a statistical appreciation of a problem are, its specification through means of a hypothetical population, the distribution, particularly of the statistics which we put forward as estimating our parameters, and finally the problem of estimation itself. While great advances have been made in each of these aspects, there is no doubt that the most striking progress in recent times has been in the researches on the theory of estimation. The notable contributor to this progress is Professor R. A. Fisher himself who chose, quite naturally, the statistical theory of estimation for his Calcutta University Readership Lectures, 1938, "an orderly presentation of the material in book form" having been brought up by Professor Mahalanobis and his colleagues at the Calcutta Statistical Laboratory.

We seek in the problem of estimation the exact properties of a population from its practical model, the sample, and it is inevitable therefore that uncertainty or probability, should attach to all operations from the very beginning namely from even the selection of the sample. The problem of obtaining presumable values was attacked as long ago as 1763 by Bayes, whose theory based upon the "principle of insufficient reason" supplies one answer, though an insufficient one, since the assumed constant probability of a parameter falling within any interval of fixed size is *not* a probability of the kind related to the empirical law of large number. Gauss-Markoff's ideas implied in the "best unbiassed estimated" later adumbrated is one result of a search for something better than the principle of insufficient reason. But the chief difficulty in this method as Dr. Neymann says, is our sophistication in taking as the best what is called the best. Undoubtedly great advances have since been made and the new principle of maximum likelihood estimate, originally due to Karl Pearson himself, and later refined by Professor R. A. Fisher now holds the field. Its chief justification lies, as even the justification for Markoff's unbiassed estimates lies, in that, under certain limiting conditions, when all the observations are mutually independent and their number n indefinitely increases, then it becomes less and less probable that the *m. l.* estimate will differ by so much from the parameter that is being estimated. Dr. Fisher's lectures to the Calcutta University reviews this position, in particular in sections 6, 7 and 8 of these lectures. His argument is as follows:—

"If, then, we disclaim knowledge *a priori*, or prefer to avoid introducing such knowledge as we possess into the basis of an exact mathematical argument, we are left only with the expression

$$\frac{n!}{a!\ (n-a)!}\ x^a(1-x)^{n-a}$$

which, when properly interpreted, must contain the whole of the information respecting x which our sample of observations has to give. This is a known function of x, for which, in 1922, I proposed the term 'likelihood'; in view of the fact that, with respect to x, it is not a probability, and does not obey the laws of probability, while at the same time it bears to the problem of rational choice among the possible values of x a relation similar to that which probability bears to the problem of predicting events in games of chance. From the point of view adopted in the theory of estimation, it could be shown in fact that the value of x, or of any other parameter, having the greatest likelihood, possessed certain unique properties in which such an estimate is unequivocally superior to all other possible estimates."

On p. 29, he enunciates (and also supplies a proof of) the proposition.

Proposition: Of the methods of estimation based on linear functions of the frequencies, that with smallest limiting variance is the method of maximal likelihood, and for this the limit in large samples of $\frac{1}{nV}$ is equal to i.

His conclusion, if it is at all possible to state that briefly, is probably best stated in his own words.

"The problem of estimation is to find from the sample point the most appropriate point on the curve of expectation. Thus every method of estimation is virtually equivalent to dividing up space into what may be called equistatistical regions such that every sample point on the same region leads to the same estimate. The criterion of consistency then simply states that the equistatistical region leading to any estimate of θ should actually cut the curve of expectation at the point corresponding to this value of θ. Efficient statistics have the peculiarity that the equistatistical region corresponding to such a statistic cuts the curve of expectation at right angles in the transformed space. The maximal likelihood solution is unique in that, in addition, its equistatistical region is linear. The equistatistical regions for minimum are not linear and touch the maximal likelihood regions on the curve of expectation."

In his last lecture there is a brief account of the manner of utilisation of the information recovered by ancilliary statistics, but the main centre of interest in his lectures lies in the statistical theory of estimation itself. Now it is well known that in any practical example the problem facing us is what value shall we take as *the* value of the parameter, and I am afraid we do not have an unequivocal guidance in such difficulty. Let us say, we are equal to the arithmetical labour involved in calculating both the Markoff best unbiassed estimate, and the Fisher m, l, estimate, and if these two do not agree, which are we to choose.

The following extract from the discussion that followed a Conference held in Washington in April 1937 at which Dr. J. Neyman dealt with statistical estimation (published in mimeograph by the U.S. Department of Agriculture, 1938) may not be irrelevant in this connection.

"Mr. Wallis: Doesn't Fisher claim that maximum likelihood solutions will always be minimum variance solutions also? I thought that Fisher claimed that he would get the 'best' estimate by the method of maximum likelihood.

"Dr. Neyman: I am aware of these claims. However, the proofs advanced by Prof. Fisher to support them were not considered satisfactory by many mathematicians and recently several interesting papers have appeared on the subject. As a result, many of Fisher's statements partly in a modified form and under certain limiting conditions, proved to be correct. I do not remember whether the particular claim you mention was found correct or wrong, but I will quote here papers by Hotelling, Doob, Dugue and Pitman, where you are likely to find the answer.

"But my point is that the question whether the variance of the m, l, estimate is minimum or not is not relevant from the point of view of the goodness of the estimate itself. In the above example, the variance of g is smaller than that of g_1, but does this circumstance prove the absolute superiority of g over g_1?"

It is very difficult to get a connected account of the Theory of Statistical Estimation except by wading through a number of periodicals but this brochure supplies a long-felt want.

We look forward to Professor R. A. Fisher to analyse with his characteristic powers of rigour and insight to further place the whole of this theory on firm and practical lines.

K. B. MADHAVA.

Theosophy and Science Meet

Where Theosophy and Science Meet—III. From Humanity to Divinity. Edited by D. D. Kanga, I.E.S. (Retd.). (Adyar Library Association, Adyar, Madras, India), 1939. Pp. 260. Price Rs. 2-4-0.

IN the course of my review of the first *two* parts of this undoubtedly stimulating series of monographs, I had pointed out that in view of basic fundamental differences between laboratory science and Theosophy (in the sense of knowledge of God and all it involves and implies) in investigational procedure and methodology and in the goal contemplated, a meeting between the two would not be productive of any good either to Science or to Theosophy, and a careful study of the *third* volume or part, now under notice, only further strengthens me in the conviction that when Science and Theosophy are detected in the act of kissing, the kiss is bound to be the kiss of Judas culminating in a betrayal of both. The progress of evolution on this planet from "Humanity to Divinity" (the *terminus ad quem* still lies lost in misty horizon) is perhaps the subject-matter of this part. The volume opens with a contribution by Therese Brosse on "Physiology". "Individualism and Functionalism" would describe the "trend of modern physiology, with reference to the hierarchy indicated by the "humoral, autonomous, and the voluntary" levels. In reference to the pituitary gland, it is claimed, that "recent discoveries of physiology" contain "some vindication for the contentions of Theosophy" (p. 20). The inevitable vitamins A, B, C, D and E are mentioned, and the author's conclusion is "Theosophy should co-operate with Physiology...." (p. 27). (2) J. Emile Marcault writes on "The Etheric Double". What is it? "It is the mediating principle between Karmic heredity of the evolving Ego and its physical vehicle" (p. 31). Modern Science has discovered "an electric organization lining up the material organism....electro-structure" (p. 34). Quite simply, the "electro-structure, highly organized electric body *is* the etheric double" (p. 38). (3) Edith F. Pinchin writing on "Mythology" refers to the "seven keys", and to the three schools of modern mythological research, *i.e.*, the Anthropological, the Psycho-analytical, and the Sociological schools, and concludes with an Appendix on the story of the Bridge Bifrost in Norse Mythology. (4) A. G. Pape sums up modern anthropological conclusions reached in the year of grace 1936, by European investigators, and by those in the U.S.A., and seeks to maintain that the Plan of Evolution "postulated" by Theosophy is most needed in Anthropology. (5) B. L. Atreya's contribution on "Philosophy and Theosophy", contains a brief survey of the different systems of European Philosophy and the Indian *Darsanas*. (6) That modern Psychology is slowly struggling towards the viewpoint of Theosophy is the conclusion arrived at by L. J. Bendit. (7) Viswanath Keskar writing on "Yoga" sums up the essentials of the theory and practice of the technique of Yoga. The Editor in his Epilogue maintains that "There is everything to gain and nothing to lose in this collaboration" (p. 236) between Science and Theosophy, and that a correlation "between Philosophy, Science and Religion, is necessary".

From the fore-sketched summary, it must be obvious that the different contributors have summed up, in some cases admirably, the conclusions arrived at by the Sciences as the result of experimental investigation. For this part of their performance, I have not merely no quarrel with them, but, have profound admiration which many of your readers will easily and readily share. When the other—doubtless the more important—part is examined, only vague and hazy lines of parallelisms are drawn between Sciences and Theosophy, with no attempt at scientific verification. Consider for instance, the doctrines of localization of cerebral centres, and the doctrine of conditioned Reflexes on which more and more light is still being thrown with advancing researches and investigation. In the extensive mass of theosophical literature, one will find, to be sure, some vague and hazy reference to glands and vitamins, to levels and strata of consciousness and concepts and phenomena like those, and from these references to demonstrated truths of modern sciences it is indeed a far, far cry. Thus, Theosophy's "postulates" in regard to "Physiology" are mentioned. But, "postulates" are not demonstrated truths or verified laws. Of course, every science is bound to have its own postulates on the foundations of which its superstructure must stand erected. A postulate ill-assorts with a demonstrated doctrine. I grant for the sake of argument that Theosophy has its own set of

verified truths, but, the striking fact is that "verification" in Theosophy is not verification by methods of qualitative analysis and quantitative measurement known to sciences.

Be that as it may, one must refuse to believe that the "Prana-mayakosa" is the "etheric double". The well-known Upanishadic view is that the self (not yet grappled by the methods of sciences) is enveloped by *five* sheaths — Anna-maya, Prana-maya, Mano-maya, Vijnyana-maya and Aanandamaya. Every sheath has potentiality of rebirth, and the outcome of previous existence. This is a metaphysical doctrine. The Yoga-program is intended to enable one to escape from the enmeshment of these envelopes. Beyond the fact, that the nerve-impulse is electric in character, nothing has been established by modern sciences. The etheric double falls far short of the metaphysical ideal of the Upanishads, and I am not quite sure if the scientifically trained conscience of the laboratory worker would be tempted or persuaded to sing hallelujas in celebration of its glory.

The articles or monographs on "Philosophy" and "Yoga" are very disappointing indeed. That the world is at present looking towards India for "light and inspiration" is either an imbecile's illusion or political propaganda of narrowest nationalism. "It is needless to say that there is hardly any difference between the outlooks of the Vedanta and Theosophy", and "In Theosophical teachings we also find all that is great in Indian wisdom" (pp. 148 and 161) are uncritical verdicts based on superficial similarities. I shall put a direct question— Advaita-Vedanta recognises as its vital truth the doctrine that Brahman is the Absolute— attributeless (Nirguna-Brahman). Does Theosophy admit this? The summary of Advaita-Vedanta on page 145 is defective. A Creator is spoken of. It should be explained that this Creator is a lower Brahman! Does Theosophy believe in *Two* Brahmans admitted by Śankara?

I do not very much mind if the term "Jnyana" is wrongly printed (p. 178 for instance) but, I must protest against the elevation of the *Bhagavad-Gita* into "the greatest authority on Yoga" (p. 77). Nor am I able to understand why the perfectly flawless division of Yoga, into Mantra-Yoga, Laya-Yoga, Hatha-Yoga and Raja-Yoga is confused with the Gita-account.

No one can be more anxious to vindicate the prestige of ancient Indian culture than I am. But, I must rather hesitate to argue that because, mention is made in the *Ramayana* of "Vimana" civil aviation was quite an ordinary and familiar phenomenon in those days. In the Editorial Epilogue emphasis is laid on collaboration between science and theosophy, between science, philosophy and religion. Collaboration, negotiation, treaties, Round-Table Conferences and attempts and amenities in that line should be among equals. Nothing succeeds like success. Laboratory sciences are to-day successful. Success-intoxicated Science is not anxious to come to terms with Theosophy. I must refuse to live in a Fools' Paradise hugging the illusion that Science is genuinely anxious to take advice from Theosophy. Rather nervousness and neurotic flutter are visible in Religion and Philosophy bewildered by the success of Science. I take it therefore, Theosophy is anxious to get recognition at the hands of Science. It remains to be seen. As the result of the kiss of Judas, I do not pretend to be able to predict, which party will perish in the bargain—whether Science or Vedanta! It is better both keep separate without shaking hands and kisses of Judas. Then both would live. Nervous Theosophy may coquette with sciences. Vedanta stands grounded on the Rock of Ages wedded in happy harmony to Truth, Beauty and Goodness.

R. Naga Raja Sarma.

OBITUARY

Dr. Walther Horn (1871–1939)

IN the afternoon of the 10th July 1939, Dr. Walther Horn, Director of the Deutsches Entomologisches Institut der Kaiser Wilhelm Gesellschaft, Berlin-Dahlem, breathed his last in his sixty-eighth year. The brief intimation of his death received by Dr. Hem Singh Pruthi, Imperial Entomologist, makes no mention of any illness but it has been evident to those, in touch with the Institute at Dahlem, that, of late, Dr. Horn had been keeping indifferent health.

Dr. Horn's contributions to entomology cover a period of nearly half a century and they are published in journals of at least three continents and in as many languages. By far the major part of his work deals with the systematics or taxonomy of Cicindelidæ, a group of insects popularly known as tiger-beetles and to the study of which he devoted practically his whole life. To-day, there will be few entomologically-known localities in the world, some part, at least, of the Cicindelid fauna of which Dr. Horn did not study, describe or record and the present knowledge of the taxonomy of this group of insects is almost exclusively based on the numerous papers contributed by him on this subject.

Essentially a systematist, Dr. Horn held very definite views on the scope and development of systematic entomology. He made no distinction between systematic and taxonomic work. If systematic entomologists could be divided into 'lumpers' and 'splitters', he certainly could not be considered to belong to the latter category. He was appalled by the number of insect species already named when probably the whole known insect fauna of the world did not exceed, in his opinion, ten per cent. of that actually existing. In an address to the Fourth International Congress of Entomology held at Ithaca in 1928, he gave forcible expression to his views on this question and, for the sake of simplifying work in future, even went so far as to suggest a tentative scheme of dividing insect taxonomy into two divisions: primary, in which the taxonomist will be concerned only up to the major groupings in a genus—"species-complexes", consisting of a number of closely-allied species grouped together, rather than species, and, secondary, in which the work will involve the division of species-complexes into lower ranks—species, sub-species, aberrations, etc.

It will be impossible to cite here even the important papers of Dr. Horn but a reference may be made to one of his early publications in collaboration with Herr Sigmund Schenkling, who preceded him as Director of the Deutsches Entomologisches Institut. This was the revised and enlarged edition of Hagen's *Bibliotheca Entomologica*, which dealt with the world literature on entomology up to the end of 1863 to which the authors added no less than 7,929 articles not listed by Hagen, thus bringing the total of papers cited to 25,229. They also showed that 3,326 authors who had written on entomological subjects prior to 1863, had been missed in Hagen's publication. Two other notable reference publications by Dr. Horn were the volume on Carabidæ-Cicindelinæ in the series *Coleopterum Catalogus* published by Junk (1926), and volumes on Carabidæ-Cicindelinæ in *Genera Insectorum* published by Wytsman (1908–15). Dr. Horn had also been editing, in collaboration with his colleague, Dr. Hans Sachtleben, the three well-known German periodicals: (1) *Entomologische Mitteilungen*; (2) *Arbeiten uber morphologische und taxonomische Entomologie*; and (3) *Entomologische Beihefte aus Berlin-Dahlem*.

Dr. Horn's views on some general questions relating to entomology were also very thought-provoking and should be more widely known. For instance, he was not a great believer in the method of applying mathematical formulæ to biological work because of the various complex factors affecting living organisms, and, hence, of the probability, that what may be sound mathematically may not always be practicable biologically. On the status and functions of an entomologist, he expressed himself very clearly. An entomologist, he said, must be determined by reference to the motive actuating his work and not merely if he happens to work on insects to elucidate problems of genetics or evolution. In other words, an entomologist is one who studies insects for their own sake and not to contribute to some other branch of the biological science.

Dr. Horn had been associated with the Deutsches Entomologisches Institut since pre-war days. He was a prominent figure at and contributed papers to, all the seven international congresses of entomology so far held. He was keenly sympathetic towards entomological organisations and workers in other parts of the world. Early in 1934, when the present writer was working at the Deutsches Entomologisches Institut, he seemed greatly concerned at a possible reduction of the staff of the Indian Museum at Calcutta, due to financial stringency, a proposal to which effect he had heard of shortly before. 'The staff should be increased rather than decreased', he said, 'because in my opinion they are doing most useful work'. Dr. Horn was a quiet and unassuming gentleman, rather frail in figure but actively interested in entomology and entomologists, an interest which now and then came forcibly to the surface and expressed itself in a few pithy sentences. To the Indian entomologists visiting his laboratory in the picturesque village of Dahlem, his help was always as unstinted as his welcome was warm. Dr. Horn's death will be greatly regretted by entomologists all over the world. K. B. LAL.

Dr. P. N. Ghatak (1902–1939)

DR. P. N. GHATAK of the Department of Botany, Calcutta University, passed away prematurely on the 14th of July last. Dr. Ghatak was born in the year 1902 in the village Hashail in the district of Dacca, Bengal. He received his early education at Dacca and graduated with honours in Botany from the Presidency College, Calcutta. In the year 1927 he obtained the M.Sc. degree in Botany of the Calcutta University and worked as a Lecturer in Botany for some time in the Presidency College, Calcutta, prior to his departure for England in 1929. He started research work in Mycology at the Imperial College of Science and Technology, London, and was awarded the Ph.D. degree of the London University for his original investigations. He returned to India in 1933 and soon after was appointed a research assistant in the Rust Research Scheme of the Imperial Council of Agricultural Research. He was appointed a member of the teaching staff of the Department of Botany, Calcutta University, in the year 1935. He organised the Department of Mycology and Plant-pathology of the University and initiated research in these subjects. He himself was employed in the study of the fungi causing damage to fruits under storage conditions.

Dr. P. N. Ghatak

Dr. Ghatak was a very successful teacher and was greatly loved by his students and colleagues for his amiable disposition. His death at the early age of 37 is a loss to his wide circle of friends, relatives and to the science of Botany.

CENTENARIES

By S. R. Ranganathan, M.A., L.T., F.L.A., *University Librarian, Madras*

Smith, William (1769–1839)

WILLIAM SMITH, an English surveyer by profession and father of English stratigraphy by reputation, was born at Churchill, Oxfordshire, a village already famous as the birth-place of Warren Hastings, on the 23rd March 1769, the same year that gave birth to Cuvier, the famous French biologist who also contributed much to the stratigraphy of tertiary formations. Smith lost his father in his eighth year. His education did not take him beyond the village school. With difficulty he procured means to purchase a few books from which he might learn the rudiments of geometry and surveying. He soon came to be interested in drainage and made such progress in his studies that at the age of eighteen he was taken as assistant to a surveyer.

His Career

From 1793 he was the surveyer and resident engineer of the Somersetshire Coal-Canal. His mastery of scientific principles, his success in dealing with difficulties in drainage and all other questions connected with water led to his being summoned to different localities and gave him almost a monopoly of work for drainage and irrigation. Thus he earned a good deal but he spent more than he earned to the cause of his first love—stratigraphy—and this brought him to penury towards the end of his career.

Foundation of English Stratigraphy

Even as a child he had begun to collect stones, particularly of the well-preserved fossils of which the jurassic rocks of his neighbourhood were full. From an early part of his professional career, his attention was arrested by the connection between the soils. His first start on geological exploration work took place in 1794 when he went to north of England as a member of a Committee to explore the route of a canal to be constructed. The constant and close observation which he was compelled to give to the strata that had to be cut through in making the canal, led him to give special attention to the organic remains in them and to perceive that "Each stratum contained organised fossils peculiar to itself, and might, in cases otherwise doubtful, be recognised and discriminated from others like it, but in a different part of the series, by examination of them". In 1799 he circulated in manuscript the order of succession of the strata and the imbedded organic remains found near Bath.

The First Geological Map

Much of his work was inserted upon maps, wherein he traced the position and range of each of the several groups of rocks with which he had become familiar. Data for maps were continuously added and in 1813 the work of engraving the grand final map was begun and it was published in 1815. This was the first geological map of England. It is 8′ 9″ × 6′ 2″ and is now exhibited in the Geological Department of the British Museum (Natural History) near his geological collection.

His Publications

As his general education was meagre, he found it difficult to write. Still under pressure from friends he overcame his reluctance to authorship and published in 1806 his *Observations on the utility, form and management of water meadows*. He also published his *Strata identified by organised fossils* (1816), *A stratigraphical system of organised fossils* (1817) and a reduced edition of his map (1819).

His Honours

In 1831 he received from the Geological Society the Wollaston Medal and Sedgwick, the President of the Society, seized the occasion to proclaim the admiration of all the geologists of England towards the man whom he named "the father of English geology". Next year the Government of William IV granted him a pension of 100 *l* a year, at the instance of the representatives of British science. In 1835 the Trinity College of Dublin conferred on him the honorary degree of LL.D. In 1838 he was employed on the Commission appointed to select the stone for the new houses of parliament.

His End

On his way to Birmingham to attend the meeting of the British Association on a special invitation, he stayed with some friends at Northampton. A cold, of which he had made light, assumed a serious form; and he died August 28, 1839.

Goodale, George Lincoln (1839–1923)

GEORGE LINCOLN GOODALE, an American botanist, was born in Saco, York County. He first studied at Amherst College, where he had been associated with Edward Tuckerman, the foremost American authority on lichens. After a year as assistant in chemistry, he studied medicine and earned the M.D. of Harvard in 1863.

His Career

After a few years of practice, when he published his botanical papers in the reports of the state survey and thereby attracted the attention of Asa Gray, he was called to Harvard in 1872 as instructor in Botany. In this modest position, he developed a lecture method characterised by finish, dignity and clarity and became so popular that the instructorship developed into an assistant professorship and later a professorship which he held till his seventieth year.

His Contributions

To the hitherto almost exclusively taxonomic interest in plants, Goodale added interest in the morphological and physiological questions, which have since so stimulated the study of nature. He was the author of the first physiological botany in America, published in 1885 as Vol. II of *The botanical text-book* of Asa Gray. By extensive travels to the sources of tea, coffee, sugar, rubber and other plant products and the collection of specimens for the Harvard Museum, he also stimulated interest in economic botany.

Goodale died April 12, 1923.

ASTRONOMICAL NOTES

Planets during September 1939.—Mercury will be a morning star for a few days in the beginning of the month and on September 22 will be in superior conjunction with the Sun. Venus will likewise be in conjunction on September 6 and will not be visible during the month. Mars will continue to be a bright object very near the meridian in the early part of the night; it is moving eastwards in the constellation Sagittarius and gradually getting fainter, its stellar magnitude on September 15 being −1·5 (nearly equal to that of Sirius).

Jupiter, which will be in opposition to the Sun on September 28, will be at its brightest magnitude −2·5, and can be seen almost throughout the night. Saturn is moving slowly in a retrograde direction in the constellation Cetus and will be crossing the meridian about a couple of hours after midnight. The ring ellipse is widening, the angular dimensions of the major and minor axes being 44″ and 12″ respectively. Uranus will be found a little to the north-east of Saturn in the eastern border of Aries. A lunar occultation of some interest that can be observed in this country is that of α-Cancri (a fourth magnitude star) on September 11.

Comets.—Periodic comet Brooks II was detected at its return on June 17 by Jaffers and Miss Adams at the Lick Observatory (U.A.I.Circ. 779). The object was exceedingly faint—of the 17th magnitude, and the physical appearance is reported to have been diffuse without central condensation or nucleus. The comet has a period of 6·94 years and is due to pass perihelion on September 15. It is likely to become bright enough to be visible with moderate optical aid. The other comets discovered this year will be very faint and can be seen only with powerful instruments.

Variable Stars.—Two well known variable stars O ceti (Mira) and χ cygni are reaching maxima at the end of August and will probably be visible to the unaided eye in September. The position of the former is given by R.A. $2^h\ 16^m$ Declination 3° 15′ South. The stars are readily identified by reference to a map. The course of their light changes can be deduced by comparing them with surrounding stars.

T. P. B.

International Congress of Anthropological and Ethnological Sciences

A pre-war organisation, known as the Congress of Anthropology and Prehistoric Archæology, was founded in Europe as early as 1865, and its reunions were held at Geneva (1912), Monaco (1906), Paris (1900), Moscow (1892), Paris (1889), Lisbon (1880), Budapest (1876), Stockholm (1874), Brussels (1872), Bologna (1871), Copenhagen (1869), Norwich and London (1868), Paris (1867), Neuchatel (1866), and Spezzia (1865). A projected session of the Congress which was to have met at Madrid in 1916 had unfortunately to be dropped on account of the Great War. After the War the *Association pour l'enseignement des sciences anthropologiques* at Paris established in the same city, under French law, a permanent organisation with the name *Institut international d'anthropologie*, with the object of "grouping, co-ordinating, and centralising the efforts of all persons engaged in anthropological problems, provided they are accepted by its *conseil d'administration*". Till the year 1927 the *Institut* did good service to anthropology, but most foreign anthropologists were not satisfied with its organisation which was international only in name. Attempts to revive the older congress and enlarge the scope of the *Institut* were not successful, but in 1933, on the initiative of Royal Anthropological Institute of London and the survivors of the Geneva committee of 1912, a conference was held at Basel to consider measures for the establishment of a truly international organisation of which the ICAES was the result. Prof. J. L. Myres (Oxford) who represented the Royal Anthropological Institute invited the ICAES to hold its first session in London.

The first session of the Congress which met in the University College, London, was an unqualified success due particularly to the organising capacity of its British General Secretary, Prof. Myres. The Duke of Onslow was the General President, and the session was opened by H. R. H. Prince George acting on behalf of his brother, the Duke of York (now King George VI) the Patron of the Congress. The work of the session was done in eight main sections: Anatomy and Physical Anthropology, Psychology, Demography and Population Problems, Ethnography, Technology, Sociology, Religion, and Language and Writing. Recommendations were adopted in regard to teaching of Anthropology and Ethnology in Schools and Universities; the need for further research into the mental aptitudes of African peoples; the creation of a permanent census of India; and training of administrators in Anthropology, etc. Committees were set up to encourage the use of films in anthropological work, for the standardisation of anthropological technique, for international research on arctic peoples and cultures, and for the compilation of a comparative vocabulary of anthropological and ethnological terms.

The second session of the Congress was held in Copenhagen in August 1938 under the presidentship of Dr. Thomas Thomsen of the Danish National Museum and the patronage of King Christian X of Denmark and Iceland, "who honoured the inaugural meeting with his presence". It was attended by over 700 delegates from all parts of the world. There were additional sections for Asiatic Ethnography, Arctic Ethnography, European Ethnography and Folklore. In addition to the existing committees fresh ones were constituted for the conservation of aboriginal people and to deal with the problems of megalithic cultures.

India is represented on the *Comité d'honneur* by Rai Bahadur Sarat Chandra Roy of Ranchi, and on the Permanent Council by Mr. K. P. Chattopadhyay, Prof. G. S. Ghurye, Dr. B. S. Guha, Mr. J. P. Mills, Dr. A. Aiyappan and Dr. B. K. Chatterji, the last two being National Secretaries for India. The functions of these representatives are "mainly to ensure that the work of the Congress is known to all students of the subjects with which it is concerned; to bring to the notice of the Congress Bureau all projects for collaborated research in which assistance is offered or desired by their compatriots; and to take the necessary measures to ensure that the next session of the Congress (which should be in 1942) is announced to Indian anthropologists and ethnologists, and that suitable communications are made by them". The official language of the Congress is French, but communications are permitted to be in German, Italian, English and Spanish.

A. AIYAPPAN.

SCIENCE NOTES AND NEWS

Study of the Oil from the Seeds of Star-anise (Illicium; Natural order: *Magnoliaceæ*). —Messrs. J. W. Airan and S. V. Shah (Rajaram College, Kolhapur), write:

The physical and chemical constants of the fixed oil (Petrol Ether extract, yield 55 per cent. on the weight of the decorticated seeds) from the seeds of Star-anise, which is reputed to be of medicinal value (Nadkarni, *Indian Materia Medica*, 1927, pp. 463) have been determined. The oil has a reddish yellow colour and does not possess any characteristic taste. The data obtained are summarised in Table I.

TABLE I

Specific Gravity at 25° C.	0·9128
Refractive Index at 25° C.	1·4677
Acid Number	11·62
Saponification value	194 ; 195
Iodine Value	88 ; 89
Reichert-Meissl value	0·746 ; 0·758
Polenske Number	0·28
Acetyl Value	8·41 ; 8·33
Unsaponifiable matter	0·5676 %

* * *

An Absolute Determination of the Acceleration due to Gravity.—In the *Philosophical Transactions of the Royal Society*, (A), 1939, 238, 65–123, J. S. Clark has given an account of a new determination of the acceleration due to gravity at the National Physical Laboratory, 51° 25′ 14″ N. and 0° 20′ 21″ W., and 10 metres above sea-level. A reversible pendulum of light metal (Y-alloy) of an I-section and one metre in length was swung from a knife-edge in vacuum. Blocks of non-magnetic delta metal were attached to the ends of the I-section rod, two exactly similar blocks B and C being fixed on opposite sides, and two more blocks D and E attached to C at one end. The blocks B and C carry planes which are supported on the knife-edge. The pressure in the tube E inside which the pendulum oscillated was less than 5×10^{-3} mm. Three platinum resistance thermometers were used to obtain the temperatures at three different parts of the pendulum. Electrical signals were produced by means of a platinum contact piece attached to the pendulum; the closing of the contact was made to short-circuit a portion of the grid bias battery of a valve circuit. This relay operated the marker which recorded the oscillations of the pendulum on a chronograph record on which another marker recorded the oscillations of the N.P.L. quartz crystal clock. A special support made of girders was used, and the knife edges were of hardened steel. The effect of the yield of the support was determined according to the method of Schumann (1899) by means of observations on the amplitudes of two pendulums swung from the support. There were 100 divisions to a second on the chronograph record and readings could be taken correct to 0·05 of a division. By observing 12,195 vibrations the half period was found to be $1{\cdot}002891_8$ sec. The length of the pendulum was found by means of a standard end-gauge. The effects of a change of amplitude and the buoyancy, drag and viscous resistance of the residual air were found to be negligibly small. Corrections were made to allow for the changes in the effective length of the pendulum on account of (1) variation of temperature; (2) the reduced pressure (the length was found to have increased in vacuum by 0·6μ); (3) the elasticity of the support (the length increased by 1·5μ); (4) the compression of the knife-edge (the length increased by 0·5μ); (5) the elasticity of the rod (the length diminished by 0·7μ); and (6) the curvature of the knife-edges (the effect on g varied from 0·0001 to 0·001 gal.). The following is the author's estimate of the likely errors on account of the various factors affecting the determination of the periods T_1 and T_2:

Temperature	± 0·6 mgal.
Amplitude	± 0·3 mgal.
Clock Rate	± 0·3 mgal.
Interpretation of Chronograph Record	± 1·1 mgal.
Radius of knife-edges	± 0·1 mgal.
TOTAL	± 1·3 to 1·4 mgal.

The final value obtained for g at the above location was 981·1815 gal. T. S. S.

* * *

Variations in Cosmic Ray Intensity and Cosmic Ray Bursts.—The analysis of cosmic ray intensity measurements carried out on voyages on the Pacific Ocean (Piara S. Gill, *Phy. Rev.*, 1939, 55, 1151) reveals that the minimum of cosmic ray intensity near the equator averages 10·3% less than that at Vancouver (lat. 54°·8). The origin of the latitude effect

can be accounted for in terms of the minimum energy required for primary electrons to produce mesotrons capable of traversing the atmosphere. The observed atmospheric temperature variations (P. S. Gill, *Phy. Rev.*, 1939, 55, 429) support Blackett's theory that it is due to changes in elevation of the mesotron producing layer with the thermal expansion of the atmosphere. The small amplitude of sidereal time variation (A. H. Compton and P. S. Gill, *Phy. Rev.*, 1939, 55, 233A) seems to show that the rays do not come directly from outside our galaxy.

The latitude effect for very large cosmic ray bursts is found to be about 30% (W. P. Jesse and P. S. Gill, *Phy. Rev.*, 1939, 55, 583). This result leads M. S. Vallarta (*Phy. Rev.*, 1939, 55, 583) to suggest that the primary particles responsible for large bursts may carry a multiple of the electronic charge in addition to possessing a large mass. The value of 10^{-4} for the creation probability of a burst by a mesotron of about 2×10^{10} ev. energy in a thickness of 12 cm. of lead (reported by P. S. Gill and M. Schein at the symposium on cosmic rays at the University of Chicago at the end of June of this year) leads to a cross-section per nuclear particle of about 2×10^{-30} cm.^{2} comparable to that estimated by Euler and Heisenberg for nuclear explosions. C. K. S.

* * *

A Contribution to Perkin's Reaction.—Gunther Lock and Erwin Bayer (*Ber.*, 1939, 72, 1064) have added further data on the effect of substituents on the yields of cinnamic acid by Perkin's reaction. Mesityl-aldehyde gave 0·5 per cent. and dinitro-mesityl-aldehyde 60 per cent. yields of the corresponding cinnamic acids prepared under the same conditions. Polynitrobenzaldehydes react so energetically that complete decomposition occurs. The effect of different halogens in the *para*-position which reduces the yield, the effect of molecular weight in homologous derivatives and of the methoxyl group have been determined. The effect of some of these conditions on Knovenagel's method of preparing cinnamic acid have also been studied and the authors conclude that though recently Knovenagel's method is more usually employed for cinnamic acid, Perkin's method generally gives higher yields.

* * *

Addition of Maleic-Acid-Anhydride to Terpene Hydrocarbons.—Diels and Alder, Dupont have already shown that maleic acid anhydride combines easily and rapidly with terpene hydrocarbons having conjugated double bonds as α-terpinine and phellandrenes forming hydrated substituted phthalic acid anhydrides. It was suggested that it can become a standard method of examination. Kurt Hultzch (*Ber.*, 1939, 72, 1173) has however found that terpenes without conjugated double bonds also give crystalline addition compounds when the components in 1:1 proportion are heated. Thus products from limonene, carenes and terpinolene have been carefully prepared and studied. Naves drew attention sometime ago that some primary and secondary alcohols as cyclohexanol, benzyl alcohol react with maleic anhydride.

* * *

The problem of replacing with metal the celluloid used for film negative has at long last been solved (according to the *Deutsche Bergwerkszeitung*, No. 165, July 1939) and a demonstration of the "Metal film" was held at Berlin last month before experts and representatives of the Press.

The metal films shown at the demonstration were of two kinds; an iron strip coated with aluminium, 0·05 mm. thick; and pure aluminium strips of 0·03 mm. thickness. The metal films are thus appreciably thinner than the celluloid films and in the case of the aluminium film actually lighter; the iron film is only slightly heavier weighing about 1 g. more than the celluloid film for every metre length of standard size.

The chief advantages of the metal film are, non-inflammability, freedom from crumpling and creasing of the light-sensitive material often experienced in celluloid films, and the greater reflecting power of the metal surface.

While the new metal films can be projected on the standard "Talkie" equipment with minor adaptations, it is not expected that the celluloid film will be replaced by metal in the near future. But, for time-exposures in microphotography, for educational films subject to frequent handling, and for film archives, the metal film is specially suited. A particular advantage offered for archives is that *both* sides of the film can be used thus economising expense and space.

The metal film was developed by Semenitz under the auspices of *Amt fur Technik*, Berlin. EMMENNAR.

* * *

Fauna of Dal Lake, Kashmir: Leeches.—M. L. Bhatia has reported on a collection of leeches taken in the Dal Lake, Kashmir (*Bull. Dept. Zool. Punjab Univ.*, Vol. II, 1–17) and finds from forms in the collection, one which is a new species of Theromyzon, called *T. mathaii*. The four forms described fall under two families. *Glossiphonia complanata*, *Theromyzon mathaii* and *Hemiclepsis marginata* belong to Glossiphonidæ and *Erpobdella octoculata* belongs to Erpobdellidæ. Detailed descriptions of the four species are given. In addition egg capsules of *Erpobdella octoculata* never before recorded from Indian forms have been described.

* * *

Corpuscles in Blood of Invertebrates.—The variety of cellular elements found in the blood of invertebrates is more abundant than that in vertebrates. But the blood cells of the former are more primitive than those of the latter. Moreover, a transformation of one cell into another is possible in case of adult healthy invertebrates and in many points the hæmolymph cells of invertebrates are similar to the embryonic blood cells of vertebrates. These are some of the conclusions that T. Ohuye (*Sci. Rep. Tohoku. Imp. University*, Dec. 1938, 13, No. 3, 359) draws from an examination of the blood fluid of 44 species of Invertebrates and Protochordates, belonging to

practically all the phyla. He does not find any fundamental difference between the erythrocytes of vertebrates and those of invertebrates. The granular inclusions found in both erythrocytes as well as leucocytes appear to be similar in their chemical reactions and probably the Erythrocytes are modified leucocytes. The lymphocyte (hyaline colourless variety of leucocytes) which is probably the simplest leucocyte, is capable according to the author, of a varied differentiation dependent on environmental factors and is probably the progenitor of all other elements found in the invertebrate body fluid. Granular leucocytes with polymorphic nuclei are however, rare in invertebrates.

* * *

African Palms as Useful Plants.—An exhaustive account of the occurrence, nativity, distribution and economic uses of the more important African Palms has recently appeared (Barret, *Der Tropenpflanzer*, 1939, 42, 185).

As compared with the Indo-Malayan region, Africa is said to be very poor in palms but it is characterised by a number of endemic genera. Of these *Jubæopsis caffra* is very interesting on account of its close affinity to the cocoanut palm. The Oil Palm (*Elaeis guineensis*), is the most important of the African Palms and apart from its oil, is the chief source of toddy for the natives; the fruit flesh is also eaten. The cultivated forms are very widely distributed while the true wild forms are found only in deep inland forests. Cocoanut (*Cocos nucifera*), date (*Phœnix dactylifera*) and palmyra (*Borassus æthiopium*) are other well-known palms found in abundance. The African palmyra differs from the Indian forms in having a prominent swelling at the top portion.

Of the various other palms, *Raffia*, so called on account of the fronds, with its 30 species, forms the richest genus. They are gigantic palms with pinnatifid leaves. The fronds which individually measure about 20 meters are responsible for their gigantic appearance, the stem itself not being particularly high. The well-known *Raffia* bast, obtained from *R. Ruffia*, is employed in making mats, floor carpets, wall screens, curtains, bags, cases for cigars and cigarettes, hats, etc. Very thin fibres are used for making clothes. Large sacks are manufactured for packing coffee and sugar. This palm is very easy to cultivate and is extraordinarily quick growing; in four years the plant attains an astonishing size.

The cabbage palm, apart from its well-known use as an edible delicacy, is also used by the natives for extraction of oil; the palm-wine is obtained from the seeds. The sweet fruits of the flabellate palms, *Hyphœne*, are highly valued by the natives. The *Rattan* is poorly represented in the African forests. The pigmy palm, *Chamœrops humilis* is found wild. Its finely divided petiole gives the export article, *Crin d'Afrique*. The vegetable horse-hair from the petiole, used for stuffing pillows, etc., is immune from the attack of insects.

There are references in this interesting article to many other palms, the numerous uses to which they are put by the African natives, and their industrial possibilities.

The only important work dealing with Indian Palms appeared in 1926 (E. Blatter, *Palms of British India and Ceylon*, Oxford University Press), but this work needs to be brought up to date. It would be a move in the right direction if the Botanical Gardens in India undertake the task of collecting and growing the world palms, in view of their economic importance.

N. KRISHNASWAMY.

* * *

The Solubility of Cements.—The solubility of cement is one of the factors affecting the deterioration of dams. An investigation has been carried out at the Building Research Station (*Research Technical Paper* No. 26, 1939, H.M. Stationery Office, London, 6d.) on methods for comparing the relative resistance of cements to leaching when soft waters percolate through concrete. The investigation is described in this publication and the results show that a relatively simple test, developed originally in Sweden, is adequate for practical purposes.

* * *

The Detection of the Carbon Bisulphide Vapour.—Leaflet No. 6 in the series issued by the *Department of Scientific and Industrial Research* on methods for the detection of toxic gases in industry deals with carbon bisulphide vapour (published by H.M. Stationery Office, 3d. net). The situations where this vapour may occur in dangerous concentrations include works where the following are manufactured:—artificial silk (viscose), chemicals, coal gas, vulcanized and "dipped" rubber goods, and tar distillation products.

In high concentrations it may cause delirium, coma, and death from respiratory failure. The better known effects, however, are those of a severe chronic poisoning of the nervous system with a great variety of symptoms, varying in degree from slight fatigue and giddiness to serious mental derangement, blindness, and paralysis.

It is stated that the permissible concentration of carbon bisulphide vapour in the atmosphere of work-rooms should be kept well below one part in 30,000 of air, and preferably not above one part in 100,000.

The standard method adopted for the detection of low concentrations of carbon bisulphide vapour in industry depends upon its interaction with diethylamine and copper acetate, to produce a coloured compound, copper diethyldithiocarbamate.

A series of standard colours is first made up by the addition of small quantities of the reagents to dilute alcoholic solutions of carbon bisulphide of known strength. Samples of the air under test are then drawn, by means of a handpump of definite capacity, through a bubbler of alcohol containing the reagents, and the mixture allowed to stand. The colour developed is compared with the series of standards, and from the number of pump strokes made and of the colour obtained, the concentration is estimated by reference to a table.

Concentrations down to 1 part in 120,000 can be estimated in this manner with 20 strokes, or less, of the pump.

Any traces of hydrogen sulphide in the atmosphere will also produce a colour with the reagent. These can, however, be removed (if not more than 1 part in 10,000) by drawing the air sample first through a filter-paper impregnated with lead acetate.

Full instructions for carrying out the tests are contained in the leaflet.

* * *

University of California Publications.—One of the recent numbers of the *Bulletins of the Geological Department, University of California* (Vol. 24, No. 8) contains a valuable paper by V. L. Vanderhoof on the Miocene Sirenian *Desmostylus*. After a thorough examination of the fossil remains of this form, the author has shown that this animal is undoubtedly a member of the Sirenia, and that *Cornwallius* must be considered to be ancestral to *Desmostylus*. The stratigraphic range of *Desmostylus* appears to be limited to the upper middle Miocene and lower upper Miocene while *Cornwallius* is confined to upper Oligocene. There is a complete Bibliography at the end, bearing on this subject and the paper is illustrated with numerous photographs and sketches.

Another of the *Bulletins* (Vol. 24, No. 9) is devoted to the study of Mount St. Helens, a recent Cascade Volcano, by Jean Verhoogen. After giving a brief account of the general geology of the region, the author proceeds to record a detailed description of the deposits due to the volcanic activity, including a petrographic account of the lavas and their chemical composition—from which he shows that Mount St. Helens contrasts with the other Cascade volcanoes hitherto described. The paper is well illustrated.

* * *

Scientific Expedition to Central Pacific.—Plans for the most extensive scientific survey yet undertaken of the vast island-studded Central and South Pacific Ocean, with a view to solving by geophysical methods some of the fundamental geological problems of the Pacific, have been announced by Dr. Gilbert Grosvenor, President of the National Geographic Society. The Expedition, which will start in September, will be in the field for a year and will be conducted by the National Geographic Society and the University of Virginia with the co-operation of the United States Coast Guard.

Arrangements for the scientific expedition, which will be made on a Coast Guard Cutter, have been reached in consultation with President Roosevelt, Secretary Hull and Under-Secretary Welles, Secretary Morgenthau and Rear-Admiral Russel R. Waesche, Commandant of the Coast Guard, who are particularly interested in the contributions to navigation, both by water and air, that will be made by the magnetic studies which are a part of the expedition's schedule. Concurrently with the carrying on of the scientific work, the Coast Guard will make a survey of the present and future needs for navigational aids and radio facilities to assist marine and air commerce.

The Expedition will be led by Professor Wilbur A. Nelson, Head of the School of Geology of the University of Virginia; the Expedition's personnel will include geophysicists, a geographer, a cartographer and a photographer provided by the National Geographic Society; experts on gravity from the U.S. Coast and Geodetic Survey; specialists on magnetism from the Department of Terrestrial Magnetism of the Carnegie Institute of Washington; and a naturalist from the Smithsonian Institution who will specialize in marine biology. The National Broadcasting Company will send radio engineers with the Expedition to investigate radio phenomena, and will arrange a number of broadcasts by members of the scientific party from remote islands.

The geophysicists will set up stations on the various islands and from them will make gravity and magnetic determinations. At the same time the geology and structure of the islands will be studied. Although a number of magnetic determinations were made in the area a decade and more ago, no gravity work has been carried on there; and never before has there been an opportunity to tie together magnetic, gravity, and geologic observations in this important region of the Pacific. The simultaneous findings in the three fields will make it possible to reach scientific conclusions that could not be deduced from the same information collected singly in any of the fields. The expedition will set up major bases on twenty or more islands; from each major base from 10 to 50 other islands will be examined.

The Expedition also will be supplied with charts showing the accurately located "epicenters" of earthquakes that have occurred in the Pacific over many years—that is, the locations directly above the points of origin of the earth waves. The scientists will correlate this information with that which their instruments reveal.

The area, 4½ million square miles in extent, which will be covered by the Expedition lies in general south of the Hawaiian Islands, east of Australia and New Guinea and north-east of New Zealand.

* * *

A Windmill Generator for Charging Batteries.—A small windmill-generator for charging a six-volt storage battery is described in *National Research Publication* No. 813. (Copies obtainable from the *National Research Council*, Ottawa, Canada. Price 25 cents.) An automobile-type generator with high-duty armature and standard cut-out, a strong mast, and a windmill blade are the main items in the unit. The first two of these may easily be obtained ready for use.

The blade may be fashioned from a piece of British Columbia spruce, white pine, maple, or yellow birch measuring at least 5′ 6″ × 1′ 6″ × 6″. Detailed instructions for making the blade are supplemented by two charts that should make the job a comparatively easy one.

It is stated in the publication that if the bearings and commutator of the generator are relatively free from friction this unit should begin charging at a wind velocity of eight miles per hour.

* * *

The Indian Lac Research Institute, Ranchi.—The *Annual Report* of the Institute for the financial year 1938–39 constitutes an impressive

record of substantial progress. Fundamental work on lac which is one of our economically important products, has been sadly lacking in this country; it is a matter of extreme gratification to observe that fundamental work on the constitution of lac has now been earnestly taken up under the direction of its present director. In the past, investigations in this field were conducted mostly in the laboratories of Europe and America and we have no doubt that should the same rate of progress be maintained the centre of research in this field will soon shift to Ranchi.

Researches on the modification of lac resins with a view to improve its properties have yielded results of technical interest. Experiments on the extraction of kiri, the dewaxing of shellac, the washing of seed lac and the production of lac-oil varnish, have been fruitful and suggestive. Shellac has been shown to be capable of being modified for rapid moulding and a scheme of co-operative research with bakelite-moulding firms has been inaugurated.

The activities of the Institute have been demonstrated before an assembly of about 80 manufacturers who wish to adopt improved methods of manufacture. This is a fine example of what should be done by other institutions in the country which claim to prosecute industrial research. We wish to warmly congratulate the Director of the Institute on the substantial contributions which he and his colleagues have made to the Indian Lac Industry and we hope that the Indian Lac Cess Committee will secure the continued services of its present Director, under whose auspices the Institute will have an illustrious and useful career.

* * *

Haffkine Institute, Bombay.—The report of the Haffkine Institute for the year 1938 which has just reached us, portrays the activities of the Institute in several useful directions, particularly in the production of prophylactic vaccines and in the diagnostic work for the hospitals. The fulfilment of these two routine but vitally important duties claimed the major portion of the resources of the Institute both in funds and personnel.

Nevertheless, Lt.-Col. S. S. Sokhey, the Director, has been able to maintain and expand the research activities of the Institute; this is largely due to the generous aid of the Indian Research Fund Association which provided both funds and personnel for the prosecution of important lines of investigation. For plague and pharmacological researches, the Association contributed about Rs. 50,000. Two voluntary workers and a Lady Tata Memorial Scholar have participated in the research activities of the Institute.

There has been a long-overdue and welcome addition of a department of medical entomology to the Institute which is to undertake investigations on the rôle of insects in the spread of disease.

During the year the Institute collaborated with the Public Health Department in an enquiry into the outbreak of typhoid in the City of Bombay, which has yielded results of great importance to the public health of the province. The value of such collaborative efforts is undoubted; there are several public health problems which need immediate investigation; but unless the staff of the Institute which is inadequate, is strengthened by a field unit, such problems vitally important as they are, cannot be tackled. It is hoped that there will be more of such collaborative effort in future.

* * *

Agra Central Observatory.—An important change will be effected in the activities of the Agra Observatory with the shifting of the Observatory from Agra to Delhi and the opening of a Forecasting Centre in Delhi decided upon by the Government of India.

The Aerological Observatory at Agra was established in 1914 purely as a research centre. The rapid development of upper air organisation since 1924 has resulted in considerable expansion of the Observatory's work. The application of upper air wind data to aviation has grown and in such a way as to surround the original functions of the Agra Observatory with an overgrowing mass of other duties particularly of organising and running a large number of pilot balloon observatories in the interests of the ever-increasing need for aviation. The decision of the Government of India to establish a forecasting centre at Delhi has provided a suitable opportunity for the consolidation and expansion of the activities of the upper air observatory. After the shift of the upper air observatory from Agra to Delhi, it will come in closer touch with aviation interests and will have access to upper air charts as used in day-to-day forecasting.

Agra controls a network of 34 stations over India and the Persian Gulf, which let off pilot balloons filled with hydrogen, twice or thrice a day. Information about the direction and velocity of the winds in the upper air, which is of great value for weather forecasting and so important for aviation, is obtained by following the course of these balloons.

The Observatory trains the staff for outstations and supplies balloons, cylinders of compressed hydrogen and all other equipment necessary for their maintenance. The daily observations from the pilot balloon observatories are telegraphed to the various forecasting centres which issue weather forecasts for aircraft, shipping and the general public. The observations taken at the stations along the regular air routes are wirelessed to planes in flight and the aerodromes. At the pilot balloon stations the data collected are scrutinised and computed in various forms suitable for publication for the benefit of the aviation and other interests and of meteorological research.

* * *

Indian Central Cotton Committee.—The half-yearly meeting of the Commitee was held in Bombay on the 3rd and 4th August, Mr. P. M. Kharegat presiding. The Commitee reviewed the annual progress reports and progammes of work of the various schemes financed by it. Among the more important schemes which were provisionally extended are: The Punjab Botanical Scheme (1 year), The Punjab Physiological Scheme (3 years), The Punjab Cotton Jassid Investigation Scheme (3 years), The Bengal Comilla Cotton Scheme (2 years), The

Hyderabad Bollworm Clean-up Scheme (1½ years) and the Surat Seed Distribution and Extension Scheme (3 years). The schemes for the improvement and development of cotton in Cutch State, for co-ordination of research work in black-headed cricket in Sind and Baluchistan, and for the improvement of cotton crop in the Kaira District (North Gujerat) were sanctioned.

The Committee noted that its proposals for the establishment of a pilot plant for the manufacture of chemical cotton at a cost not exceeding Rs. 50,000 had been sanctioned by the Government of India.

The recognition by the *Bureau International Pour La Standardisation Des Fibres Artificielles* of the Technological Laboratory of the Committee as a neutral Testing House for India to test artificial silk yarns was noted.

* * *

Abundance of Hilsa Crop in 1939.—At the ordinary monthly meeting of the *Royal Asiatic Society of Bengal*, held on the 7th August, Dr. S. L. Hora communicated a note relating to his observations on the abundance of Hilsa crop this year. "Sir K. G. Gupta and later writers on the fisheries of Bengal were generally of the opinion that *Hilsa* is becoming scarce and recommended the establishment of hatching stations to introduce artificial propagation for replenishing the rivers of Bengal. Further, it is still fresh in our memory that the *Hilsa* crop was very poor in 1937 and 1938. Its great abundance in 1939, therefore, has come as a pleasant surprise to the fish-eating population of Bengal and consequently this fact has received considerable attention in the public press." In explaining the probable causes for this unexpected increase in the yield of the fishery for this year, Dr. S. L. Hora gave a brief account of the life-history and the periodic rise and fall in the annual yield of the *Hilsa* fishery.

* * *

Syntomosphyrum indicum.—Information is now available regarding the spread of this chalcid which was introduced into Australia in order to check the fruit fly menace (*Curr. Sci.*, 1938, 7, 302).

In the latter half of the year 1935, Mr. W. B. Gurney, B.Sc., Entomologist of the Department of Agriculture, Sydney, New South Wales, visited India and for some months carried out investigations to recover parasites of fruit flies which might possibly be of value if introduced into New South Wales to attack fruit fly there. Several species of wasp parasites of the genus *Opius* (*Braconidæ*) were developed and batches of parasitised Indian fruit fly pupæ were despatched to Australia. Some adults of these Braconid wasps developed on arrival in Sydney, but failed to oviposit and develop in the laboratory in local fruit fly maggots (*Chætodacus*) in fruit presented to them.

In November, 1935, batches of living adult parasitised chalcid wasps (*Syntomosphyrum indicum*) developed from Indian fruit flies (*Chætodacus*), were sent to Sydney, N.S.W., by air mail. Unfortunately, they arrived at a time when no fruit fly maggots were obtainable to expose to these living parasites, and they died out without progeny. However, Mr. Gurney arranged for the Government Entomologists at Bangalore and also at Coimbatore to forward further batches, if obtainable.

In October, 1937, through the courtesy of the Entomologist at Bangalore, a batch of fruit fly pupæ was sent from Bangalore. From these a few of the chalcid wasp parasite *Syntomosphyrum indicum* were hatched in the quarantine insectary of the Department of Agriculture, Sydney. The Entomological Branch here was able to obtain numerous fruit fly maggots and developed increasing numbers of this introduced parasite in the Insectary until, over a period of 5 months, *viz.*, December 1937 to April 1938 some 260,000 living specimens of this introduced parasite were developed and liberated in New South Wales and Queensland and Fiji.

Since that date the aim has been to endeavour to recover in the field living specimens of this parasite during the summer season, *viz.*, from October 1938 till May 1939. So far, however, not a single parasite has been recovered to indicate that this parasite has become established here. Fruit fly maggots and pupæ will be collected throughout the next summer season 1939–40, in a further endeavour to prove whether even a few of the parasites succeeded in surviving in certain of the warmer districts of New South Wales or Queensland. It was always felt that, as these are tropical parasites they might be unable to face the winter conditions of N.S.W., but there was more hope that they might succeed in establishing themselves in the northern sub-tropical areas of N.S.W., or in the tropical parts of Queensland. Fiji also having a tropical climate, the parasite may succeed in establishing itself there.

It will be seen, therefore, that though a very successful development of this parasite was made in the laboratory, and a very big field liberation made, yet, until actual recoveries are made in the field, no claim whatever for success in establishing this parasite or in estimating any results of its presence can be made.

* * *

The Syndicate of the University of Bombay have awarded the **Moos Gold Medal** for the year 1938–39 to Dr. N. C. Chatterjee, Entomologist at the Forest Research Institute and College, Dehra Dun, for his D.Sc. thesis in Zoology. Dr. Chatterjee took the A.I.I.Sc. diploma in 1935 and D.Sc. in 1938. He is a graduate of the Allahabad University and is the first candidate to achieve this distinction in Zoology from the Bombay University.

* * *

Lucknow University.—Messrs. A. Ramachandra Rao and K. Jacob who have been working under Prof. B. Sahni, F.R.S., have submitted their theses which have been approved by the examiners for the D.Sc. Degree of the Lucknow University. The work of these two authors has been warmly commended by the examiners.

Mr. A. Ramachandra Rao's thesis comprised several papers (some published and others unpublished) on the Jurassic Flora of India. (1) The anatomy and affinities of *Taeniopteris spatulata* McClelland. (2) Two petrified strobili from the Rajmahal Hills, Behar. (3) Notes on the anatomy of some silicified ferns from the Cretaceous of Germany. (4) On a collection of

Jurassic plants from the Rajmahal Hills, Behar. (Jointly with Prof. B. Sahni.) (5) *Rajmahalia paradoxa* gen. et sp. nov., and other Jurassic plants from the Rajmahal Hills. (Jointly with Prof. B. Sahni.) (6) Further observations on *Rajmahalia paradoxa*. (Jointly with Prof. B. Sahni.)

Mr. Jacob's thesis comprised five papers (two published and three unpublished) nearly all of them dealing with the Jurassic Flora of India and Ceylon. The full titles of the papers are as follows: (1) Fossil plants from Sakrigalighat in the Rajmahal Hills. (2) On the structure and affinities of *Tinpaharia*, a new Genus of petrified ferns from the Rajmahal Hills. (3) Jurassic Plants from Tabbowa. (4) On *Protocyathea rajmahalense* sp. nov., A Cyatheaceous Tree-fern, with notes on the geological distribution of the Cyatheaceæ. (5) Fossil Algæ from Waziristan.

* * *

Dr. Wilbur A. Sawyer, Director of the International Health Division at the Rockefeller Foundation, has been awarded the Leon Bernard Foundation Prize by the Health Committee of the League of Nations at its meeting held on May 1, 1939. The Committee "wished to pay a tribute to the valuable work done by Dr. Sawyer in combating yellow fever, and in the sphere of medico-social protection, which has benefited the populations of a large number of countries".

The prize consists of a Bronze Medal bearing the effigy of Leon Bernard and a sum of 1,000 Swiss francs. This is the first award made by the Foundation.

* * *

The Growth, Properties, and Structures of Wood.—The inherent variability of timber is an important obstacle to its most effective utilization. A recent report (*Forest Products Research Special Report No.* 5, 1939, H.M. Stationery Office, London, 9*d*.) reviews the present position of knowledge of the anatomical structure of wood, and of the physico-chemical composition of the cell walls, in relation to growth conditions on the one hand and physical and mechanical properties on the other, summarizing the conclusions reached during recent investigations carried out at the Forest Products Research Laboratory. The relative importance of the features determining the properties of wood is discussed from a practical standpoint, and indications are given of the influence of growth conditions on the physico-chemical composition of the wood substance.

* * *

At a meeting of its executive committee held on Friday, the 18th August 1939, the **Association of Technologists, Bangalore,** formed *three* sub-committees: (1) to complete a list of Scientific Instruments and apparatus available in the various laboratories and other institutions in Bangalore; (2) to draw up a list of Scientific Journals and periodicals available in the various libraries and institutions in Bangalore; and (3) to report on the design and construction of laboratories specially suitable for Indian conditions.

* * *

The Finch Electron Diffraction Camera.—The technique of the study of surface structure of single crystals and polycrystalline specimens by electron diffraction methods has reached a high degree of perfection, thanks to the work of Professor Finch and his collaborators. The electron diffraction camera often yields far-reaching results which cannot be envisaged either by microscopic study or by X-ray diffraction methods. The microscope reveals only the coarse structure of the surface of a specimen; X-rays on the other hand give us information about the internal structure of a specimen; but an electron beam, of the same wave-length as the X-rays usually employed, has extremely low penetrating power so that it can be used for the study of the fine structure of surfaces. The three methods, *viz.*, microscopy, X-ray diffraction and electron diffraction, used in conjunction should, therefore, yield all available information about the internal and surface structures of any specimen. While microscopes and X-ray equipments for such work are readily available on the market it is comparatively more difficult to get an electron diffraction camera incorporating all the refinements such as those introduced by Professor Finch. **Messrs. W. Edwards & Co.**, are to be congratulated in having supplied this long-felt need. Their electron diffraction camera, of the Finch type, illustrated in their special folder, is a well-designed complete unit. One can foresee a time when this apparatus will be as common as a microscope in research and technical laboratories.

S. R. S.

* * *

Announcements :

Imperial Dairy Institute, Bangalore.—Students will be admitted this year for the Indian Dairy Diploma course. The course commences in November and is of 2 years' duration. The course includes technical and practical training in dairy and animal husbandry subjects, management of dairy farms, co-operative milk unions, etc.

The Institute also arranges for a post-graduate course (15 months) for agricultural and veterinary graduates and for officers working in the allied Government departments who are desirous of obtaining post-graduate and advanced research experience in animal husbandry.

A well-equipped bacteriological and chemical laboratory is attached to the Institute.

National Centre for Distribution of Biological Products.—The *Biochemical Standardization Laboratory*, All-India Institute of Hygiene and Public Health, Calcutta, has been constituted a 'National Centre' for the distribution of standard preparations of biological products to those who ask for them. If laboratories intimate their requirements, the Centre will import and supply the appropriate standards.

Standards have been established for many products by the Biological Standardization Committee of the League of Nations, and the actual "standard preparation" of each kind is maintained and issued to research and manufacturing laboratories by specified Institutes, such as the

National Institute for Medical Research, Hampstead (under the Medical Research Council) and the State Serum Institute, Copenhagen. For convenience of distribution of the "standards" to those that require them, it has been found advisable to form "National Centres" in countries where biological products are manufactured. These centres receive duplicates of each standard at intervals and issue them to working laboratories for the control of their preparations.

The following are the standards which will be available at the Laboratory:—

Insulin;
Pituitary (Posterior lobe) Standard Powder;
Oestrus-producing Hormones (i) Hydroxy-Ketonic form, (ii) Mono-benzoate of Di-hydroxy form;
Male Hormone (Androsterone);
Corpus Luteum Hormone (Progesterone);
Neoarsphenamine;
Sulpharsphenamine;
Ouabain or Strophanthin;
British Standard Tinct. Strophanthus;
Standard Digitalis Powder;
Adrenaline and Scillaren Standards; and also
Chorionic Gonadotrophin (from pregnancy urine).

Messrs. **The Cambridge University Press**, London, announce that the following are among their forthcoming publications. Sir Arthur Eddington: *The Philosophy of Physical Science*; Prof. R. A. Millikan: *Cosmic Rays*; Dr. A. S. Eve: *Lord Rutherford*; Prof. August Krogh: *Osmotic Regulation in Aquatic Animals*.

Forestry Abstracts.—The Imperial Forestry Bureau issues a quarterly journal entitled *Forestry Abstracts*. This will provide a survey in English of the current literature of forestry from all parts of the world. Each issue will normally include special reviews of the literature of particular subjects, notes on annual reports, and abstracts classified by subject. In the abstracts the aim is to epitomize the contents of each paper so as to enable the reader to judge of its value as a contribution to knowledge. In addition to papers in English, French and German, attention will be directed to those published in the less familiar languages.

The first number appeared in June 1939. *Forestry Abstracts* will appear quarterly in September, December, March and June, four numbers constituting a volume. Indexes will be provided annually.

The annual subscription will be:—For residents of the countries of the British Commonwealth and the Anglo-Egyptian Sudan who send their subscriptions direct to the Bureau, 20*sh.* and for all other subscribers, 25*sh.*

* * *

We acknowledge with thanks, receipt of the following:—

"Journal of Agricultural Research," Vol. 58, Nos. 10–11.

"Agricultural Gazette of New South Wales," Vol. 50, No. 7.

"The Philippine Agriculturist," Vol. 28, No. 2.

"Indian Journal of Agricultural Science," Vol. 9, Pt. 3.

"L'Agricultura Coloniale," Vol. 33, Nos. 2–3 and 6.

"Allahabad Farmer," Vol. 13, No. 3.

"Biochemical Journal," Vol. 33, No. 6.

"Berichte der deutschen chemischen gesellschaft," Vol. 72, No. 7.

"Contributions from the Boyce Thompson Institute," Vol. 10, No. 3.

"Journal of Chemical Physics," Vol. 7, No. 7.

"Chemical Age," Vol. 41, Nos. 1045–1047.

"Journal de chimie physique," Vol. 36, Nos. 4–5.

"Russian Journal of General Chemistry," Vol. 9, Nos. 4–9.

"Chemical Products," Vol. 2, No. 3.

"Comptes Rendus," (DOKLADY), Vol. 23, Nos. 1–7.

"Experiment Station Record," Vol. 80, No. 6 and Index to Vol. 79.

"Indian Forester," Vol. 65, No. 8.

"Forschungen und Fortschritte," Vol. 15, Nos. 19–21.

"Transactions of the Faraday Society," Vol. 35, No. 219.

"Genetics," Vol. 24, Nos. 3–4.

"Bulletin of the Health Organisation (League of Nations)," Vol. 8, Nos. 1–2.

"Transactions of the Mining, Geological and Metallurgical Institute of India," Vol. 35, Pt. 2.

"Review of Applied Mycology," Vol. 18, No. 6.

"Calcutta Medical Journal," Vol. 36, No. 1.

"The Mathematics Student," Vol. 6, No. 4.

"Bulletin of the American Meteorological Society," Vol. 20, No. 5.

"Indian Medical Gazette," Vol. 74, No. 7.

"Indian Journal of Medical Research," Vol. 27, No. 1.

"Nature," Vol. 143, No. 3634; Vol. 144, Nos. 3635–3638 and Index to Vol. 143.

"Journal of Nutrition," Vol. 18, No. 1.

"Canadian Journal of Research," Vol. 17, No. 5.

"Journal of Research (National Bureau of Standards)," Vol. 22, Nos. 1–2.

"Sky," Vol. 3, No. 9.

"Science Progress," Vol. 34, No. 133.

"Indian Trade Journal," Vol. 134, Nos. 1725–1729.

Catalogues:

"Scientific and Technical Books, June 1939" (Edward Arnold & Co). "The Cambridge Bulletin," No. 84 (Summer 1939).

ACADEMIES AND SOCIETIES

Indian Academy of Sciences:

July 1939. SECTION A.—N. V. SUBBA RAO AND T. R. SESHADRI: *Use of Mercuric Acetate in organic preparations—Part I. Mercury compounds of Amides and Imides.* S. RANGASWAMI AND T. R. SESHADRI: *3-Benzoyl-7-Hydroxyflavone.* M. SALARUDDIN AND C. K. ANANTHASUBRAHMANYAM: *The Bright Solar Eruption of March* 3, 1939.—One of the brightest and largest eruption observed in Kodaikanal during the last two years is described. S. S. PILLAI: *On Normal Numbers.* V. S. VRKLJAN: *Ein Versuch der Erweiterung des Krishnanschen Reziprozitatsgesetzes für Schiefe Beobachtungsebenen.*—Krishnan's reciprocity relation is extended to inclined planes of observation. N. V. RANGASWAMY IYENGAR AND BASRUR SANJIVA RAU: *Interfacial tension studies on Mercury in reacting systems.*—Measurements have been made in systems containing H_2S and SO_2 in CCl_4, sulphur in CCl_4, $KHgI_3$ in water, and $KHg(CN)_2$ in water. D. N. MOGHE: *On a simple system of charged particles in Milne's kinematical theory.* G. S. KASBEKAR AND A. R. NORMAND: *Reaction between Nitric Acid and Tin in presence of Catalysts—Part II.*—Iodides of sodium and potassium retard the reaction. D. N. MOGHE: *On the Stability of Motion in Milne's kinematical system.* S. S. BHATNAGAR, P. L. KAPUR AND G. MITTAL: *Magnetic Properties of Copper Amalgams.*—Amalgams have been prepared under definite conditions by different methods and examined. The observation that copper becomes paramagnetic in dilute amalgams is attributed to formation of paramagnetic oxides during prolonged electrolysis. S. DUTT AND IONE N. D. DASS: *Colour in relation to chemical constitution of the Organic and Inorganic Salts of Isonitroso-Pyrazolones and Isooxazolones.*

July 1939. SECTION B.—T. S. SADASIVAN: *A study of the Growth Reactions of non-parasitic Fungi in Associated Culture.*—The first of a series dealing with the growth reactions, primarily of two non-parasitic fungi, *Fusarium* and *Dendryphiella* in associated cultures. B. N. SINGH AND J. R. SINGH: *Effectiveness of chemical fertilisers on the growth and water requirement of wheat.*—The application of fertilisers, besides showing a higher yield of the crop, has the added advantage of minimising the cost of irrigation. L. S. RAMASWAMI: *Some aspects of the anatomy of anura (Amphibia)*—A Review. C. V. GANAPATHY AND B. N. SASTRI: *Oxidation of Thiols and Ascorbic Acid in the Latex of Papaya.*—Thermolabile systems responsible for maintaining thiols in the reduced condition are present in the latex and pulp-juice of the Papaya fruit. K. S. SRINIVASAN: *On the developmental morphology of androgynous receptacles in* Marchantia palmata *Nees.* G. W. CHIPLONKER: *Bryozoa from the Bagh Beds.*—A detailed study of the Bryozoa obtained, in the main, from the Upper Coralline Limestone, the uppermost member of the Bagh Beds, shows that no species are identical with or even allied to any of the forms described from South India. The Bryozoan fauna can be assigned to a horizon at about the Cenomanian.

Indian Association for the Cultivation of Science (*Proceedings*)

April 1939.—A. C. BANERJI AND NIZAMUDDIN: *Jupiter's Atmosphere.* P. L. KAPUR: *A Note on the Transmutation Function for Deuterons.* S. R. DAS AND K. GHOSH: *A Study of Sulphur Allotropes by the X-ray Diffraction Method—Part II.* S. K. MITRA AND A. K. BANERJEE: *The Light Theory of Aurora and Magnetic Disturbance.*

June 1939.—A. K. SEN GUPTA: *Band spectrum of antimony monoxide.* B. M. ANAND AND S. NARAIN: *On the Raman effect in camphor.* A. K. DUTTA, M. K. CHAKRAVARTY AND S. R. KHASTGIR: *An experimental study of parabolic wire reflectors on a wave-length of about 3 metres.* P. C. MUKHERJI: *On the absorption and emission spectra of rare earth crystals.* J. A. N. THAES: *Measurement by means of the electrometer triode.* M. V. SIVARAMAKRISHNAN: *An improved form of vacuum arc mercury still for laboratories.* S. K. MUKERJI AND S. ABDUL AZIZ: *On the Raman spectrum of o-Diphenylbenzene.* D. M. BOSE AND P. C. MUKHERJI: *On the colour of paramagnetic ions in solution, II.—Fine structure of the absorption bands.*

Meteorological Office Colloquium, Poona:

July 15, 1939.—PROF. K. S. KRISHNAN: *The Paramagnetism of Crystals.*

Botanical Society of Bengal:

July 28, 1939.—S. HEDAYETULLAH AND A. K. CHAKRAVORTY: *A comparative study of the construction of mechanical system in the five species of the genus oriza preliminary to the study of lodging of rice plants.*

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